BUILDING A TELEVISION RECEIVER

PRACTICAL TELEVISION

9D.

EDITOR F. J. CAMM

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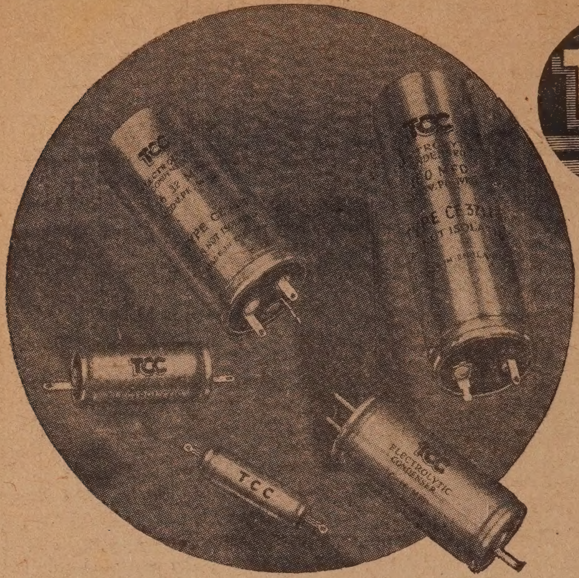
IN THIS ISSUE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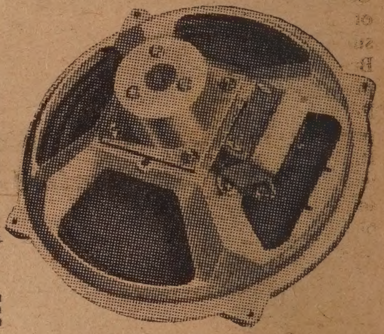

᛫# PRACTICAL TELEVISION

Editor : F. J. CAMM

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Televiews

TV Aerial Ban—Industry Action

THE introduction of radio in 1922 was accompanied by a similar opposition to the erection of outdoor aerials as is now shown by some unenlightened local authorities to the erection of television aerials. In those early days of radio an outdoor aerial was considered a necessity because of the comparatively low-powered transmissions and the corresponding weak signal strength. The opposition soon died, however. As the power of transmitters increased the need for outdoor aerials except in special areas vanished, indoor aerials giving satisfactory results. Receivers, too, developed from crystal sets to multi-valve sets and the efficiency of radio components in combination with these other factors finally eliminated what was considered the unsightly outdoor aerial.

The industry has taken prompter action over this matter than was taken in 1922. The Radio Industry Council has issued a booklet giving expert guidance on television aerials and it has been circulated to the surveyors of local authorities throughout Great Britain and Northern Ireland. It is also intended for private property owners and is on sale to the public. Published jointly by the Radio and Electronics Component Manufacturers Federation and the British Radio Equipment Manufacturers Association, it deals with the many factors which must be considered before the type of aerial most suitable for any particular building or district can be selected. It is emphasised that these factors can only be determined by means of tests carried out on the site. The factors affecting reception are listed, communal and multi-point systems for blocks of flats are described and eight types of television aerial are classified.

PROPOSED LINK WITH PARIS

A memorandum submitted by the Radio Industry Council to the Postmaster-General contains an offer to establish a cross-channel television link and to maintain it for a year. It states that engineers of both countries have solved the problem of transmitting television programmes over considerable distances by radio or cable link. The techniques are well tried and proved and there will be no difficulty in providing the necessary links from London to the English coast, across the channel, and from the French coast to Paris via Lille, where a radio link to Paris is understood to be far advanced.

The memorandum states that the installation costs should not be high if full use is made, for example, of the B.B.C. experimental station at Wrotham, located on the line from London to the coast of Dover. The industry generously states, so firmly convinced is it of the value of establishing a cross-channel link, that it is prepared to instal temporary apparatus to establish it at the earliest date. The link would consist of two coastal stations, one on each side of the channel, at sites to conform with locations of the overland links in France and England.

The advantages of such a link are many, and not the least is that shared programmes must reduce costs. Also, it would add variety to the programmes.

Experience in France and Britain has shown that entirely satisfactory pictures both for home viewers and for audiences for large screen pictures in cinemas can be obtained with the existing transmitting standards in use in the two countries. The transmission would be on 405 lines, for which economic and engineering advantages are claimed over all other systems.

Increases in the number of lines can improve the picture under laboratory conditions, but immediately it is transmitted the cost of the home receiver is increased, as also is the cost of the transmission lines necessary to link the camera with the transmitter.

A further point is that the ether space at the disposal of television is inevitably limited. Fewer lines and standardised transmissions would result in more channels being available and, therefore, more stations capable of interference-free working in a given area.—F. J. C.

PUBLISHER'S ANNOUNCEMENT

OWING to the withdrawal of overtime working which has been imposed by a section of the printing industry in London and the lateness of publication caused thereby, we have been reluctantly compelled, in order to make up lost time, to produce our next issue as a combined September - October number, which will be published on Sept. 15th.

We express our regrets to readers that no other course is open to us. Whilst the dispute continues delays in publishing may continue.

Building the

P.W. TELEVISION RECEIVER

Chasis Details and Preliminary Constructional Work

THE use of separate electrolytics at each section, as mentioned last month, is an alternative to using standard main H.T. smoothing capacitors. Instead of using one or two large-capacity condensers in the mains unit, they are split up into small sections and included at each part of the circuit so that they act as decouplers, provide better smoothing, and are cheaper in replacement when called for. The total H.T. smoothing capacity is thus 78 μF.

List of Parts

In last month's issue will be found a full list of the components required for the receiver, and it will be noted that a special choke is required with a rating of 250 μH. This choke must have a low self-capacity and its construction will be described in a later issue. All other components are standard items in good supply, and no difficulty should be experienced in obtaining any of them.

Chassis Details

The illustration below shows how the receiver is divided into sections, vertical screens being erected on the chassis to provide most of the divisions. To render construction as simple as possible, these screens are placed in after most of the wiring has been completed, and thus all parts are readily accessible for the attachment of nuts, etc., and for the actual wiring. The R.F. valveholders in the vision and sound sections are fitted with vertical screens and the associated resistors, and condensers are wired up before mounting, the valveholders in place, whilst the screen separating sections 4 and 5 is fitted with the ready-wired tag-boards and the two oscillator chokes before it is put into position. However, these facts will be fully covered when dealing with the wiring next month, and the first part of the work is to make up the chassis and screens. Fig. 2 shows the layout of the chassis, and it will be noted that only two drills and a disc-cutter or special chassis punch (for the valveholders) are needed. The chassis should be cut from fairly stout aluminium—say, 20 S.W.G., and the remaining screens and focusing unit mount from the same material. In addition, six pieces of stout tinplate are also required cut to the size shown in the top right-hand corner of Fig. 4 on page 198. These are mounted on the valveholders as already mentioned.

Chassis Drilling

The chassis should be cut out to the dimensions given in Fig. 2, noting that a cut must be made at each corner to allow the sides to be turned down and an overlap provided. For the valveholders 1⅛in. and 1⅜in. holes are needed, and no difficulty should be experienced in identifying which is which, although in order to keep the diagram clear the measurements are only given twice.

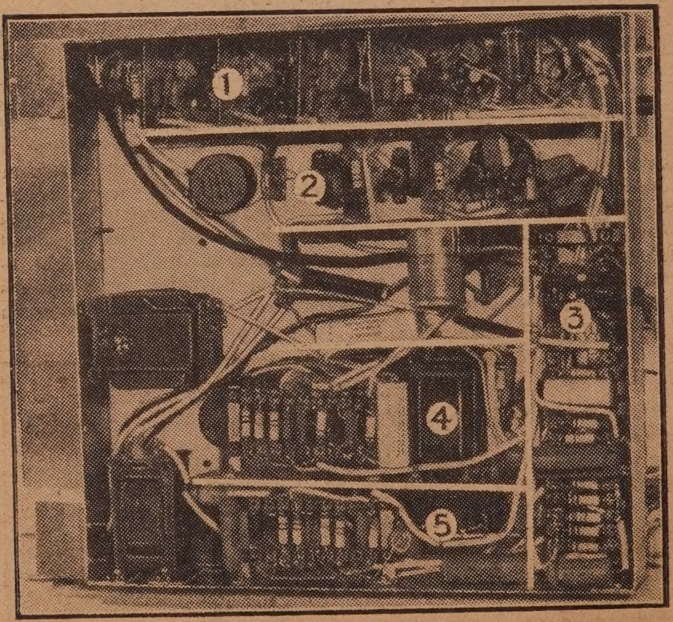


Fig. 1.—Underside of chassis. Section 1 is the vision receiver ; Section 2 is the sound receiver ; Section 3 is the sync. separator ; Section 4 is the frame time-base ; Section 5 is the line time-base.

All of the small holes shown are for the clearance of the 6 BA. bolts used for attaching screens, valveholders, coils, etc., and may be drilled either with a one-eighth or a No. 33 drill. The remaining holes are ⅜in. diameter and on the rear strip you can open out a ⅜in. hole to approximately ½in. to accommodate a larger grommet to take the grouped supply leads or, alternatively, may drill two holes each ⅜in. and use two grommets and split the supply leads into two groups. At the front runner of the chassis are two further holes (their position is not critical) but in some cabinet designs it may be preferable to omit the two brackets mounted at this position and mount the volume and brilliancy controls direct on the cabinet front, taking the leads from these controls through the holes or below the chassis, according to the method of installing the chassis. Before drilling the mounting holes for the four Haynes' chokes and transformers, check up the spacing on the lugs, or lay them over the screen (lower one in Fig. 3) and the sides of the chassis, and mark them from the actual component. Incidentally, two 4 BA screws will have to be used to attach the line transformer and the original holes may be opened with a

file tang if a suitable drill is not available. When mounting these four components, carefully clean away the wax round the feet to ensure that the holding-down nuts are well locked down.

Mounting the Components

When the chassis has been drilled satisfactorily, it should be bent up and the corners locked with ⅜in. 6BA bolts and nuts. Bending may be carried out by clamping the metal between two pieces of stout wood or lengths of metal clamped in a suitable vice. At each of the coil-mounting positions fit a ¾in. bolt and lock it in position with a nut. Later the coil formers may be dropped over the projecting bolts and locked up, and this avoids the difficulty of having to register the holes in chassis and coil former and pass a bolt through and put on a nut at the same time. Attach the various controls—contrast being that at the top of section 2 with the two 500-ohm controls on a level with it at the other side of the chassis. The Form and Hold controls are in a line behind these two (viewing the chassis from the front) and reading from left to right are: Form Hold (Line) and Form Hold (Frame). Next mount the two output chokes to the front and sides of the chassis and then all the valveholders—noting that the screws holding the first and sixth vision valveholders also grip the two coaxial clamping pieces. The five three-way tag strips are then fitted, after which the 32 μF. condenser should be attached to the 7in. vertical screen and then the two chokes should be attached to the 8in. screen.

Valveholders

The B9G valveholders are silver plated, and as will be seen next month the earthed points of the anode and grid circuits are "commoned" on the actual valveholders which are built up as small separate units. For the time being the small tinplate screens should be soldered to six of these holders, placing them across pins five and nine in such a manner that the central spigot clamping tag is against the screen, soldering the tag to the screen on

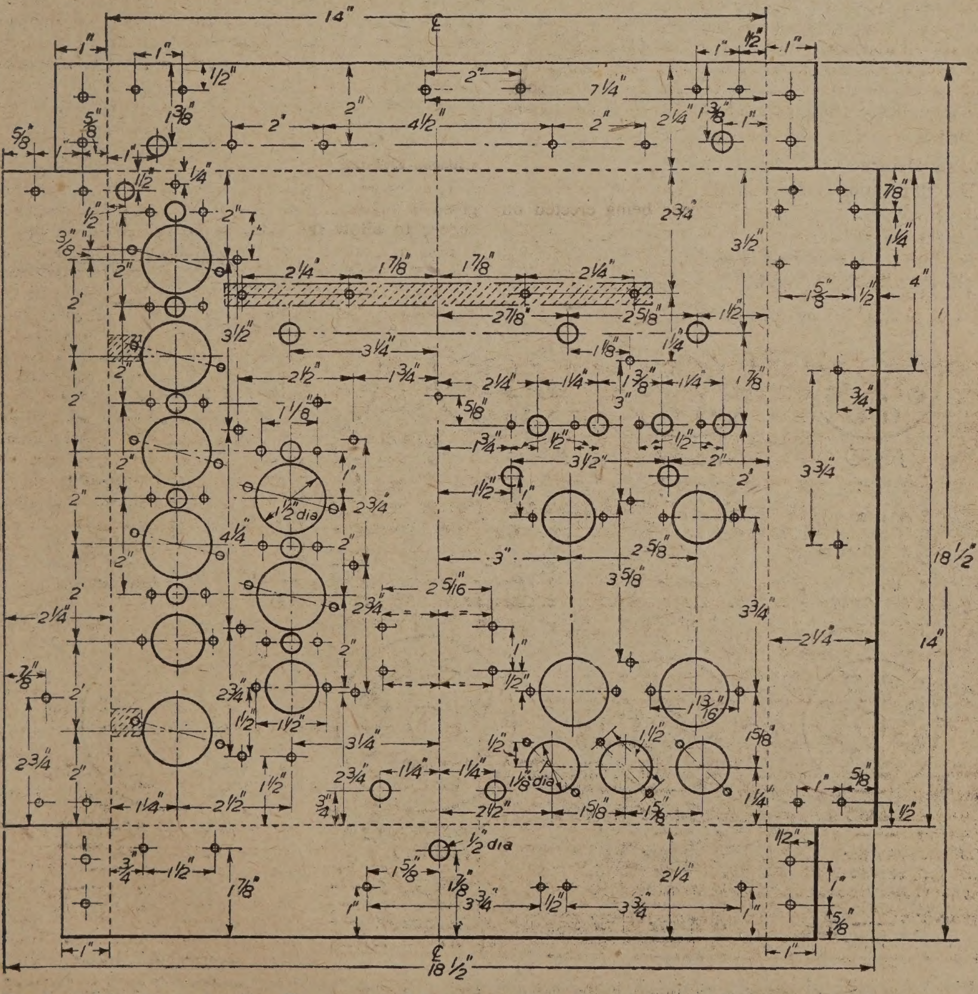


Fig. 2.—Main chassis details. The unmarked holes are either ¼in. or ⅜in. in diameter and suit grommets, variable controls, and clearance for 6 BA bolts.

one side and the two valveholder tags on the other side. The screens should be pushed down level with the top of the insulated part of the valveholder and this will leave space between the screen and chassis when in position to permit the L.T. and H.T. leads to pass between them.

The only remaining piece of work for this section is the focusing magnet mount, and details of this are given in Fig. 5. Note that the bottom is bent in two different directions, and check the mounting holes with those in the chassis after bending as the thickness of the metal and the acuteness of the bend may affect the spacing between the two sets of holes. Alternatively, this piece may be constructed and the holes marked through on to the chassis and the latter drilled last.

Before going on to the wiring which will be dealt with in the next issue there are a few points which perhaps may not be clear to those who did not see the receiver at Radiolympia. First, the tube is held in position by being clamped between the long front runner on the chassis (top of Fig. 3), and a wooden support which is attached to the chassis by four No. four or five ⅝ in. round-head screws. The wooden support is preferably made from ½in. plywood and its position is indicated by the shaded area in Fig. 2. The support measures 9¼in. by 9¼in. and has a 6½in. diameter hole cut centrally. This hole is lined with a short length of rubber draught excluder and the tube is inserted from the front and presses against the rubber. A standard rubber mask is fitted over the front of the tube and in front of this the sheet of plate glass is pressed in the inner turned-up edge of the piece of metal already referred to (top of Fig. 3). Another piece of aluminium (or if preferred two narrow strips), may then be put over the top of the wooden support and across to

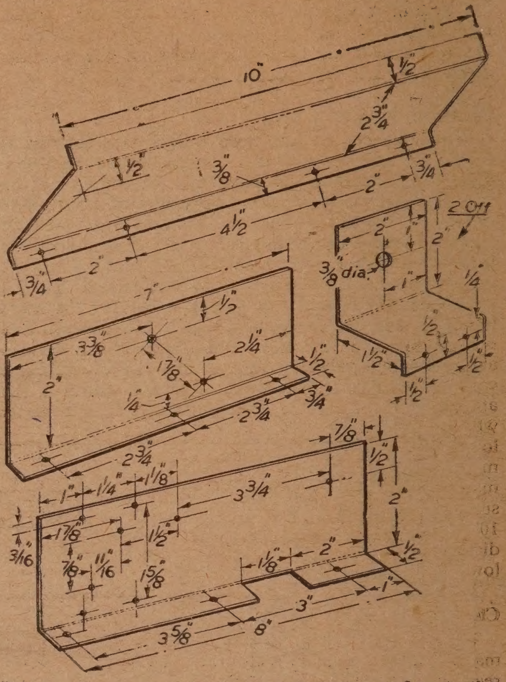


Fig. 3.—Separating screens, control mounts, and protective glass mount details.

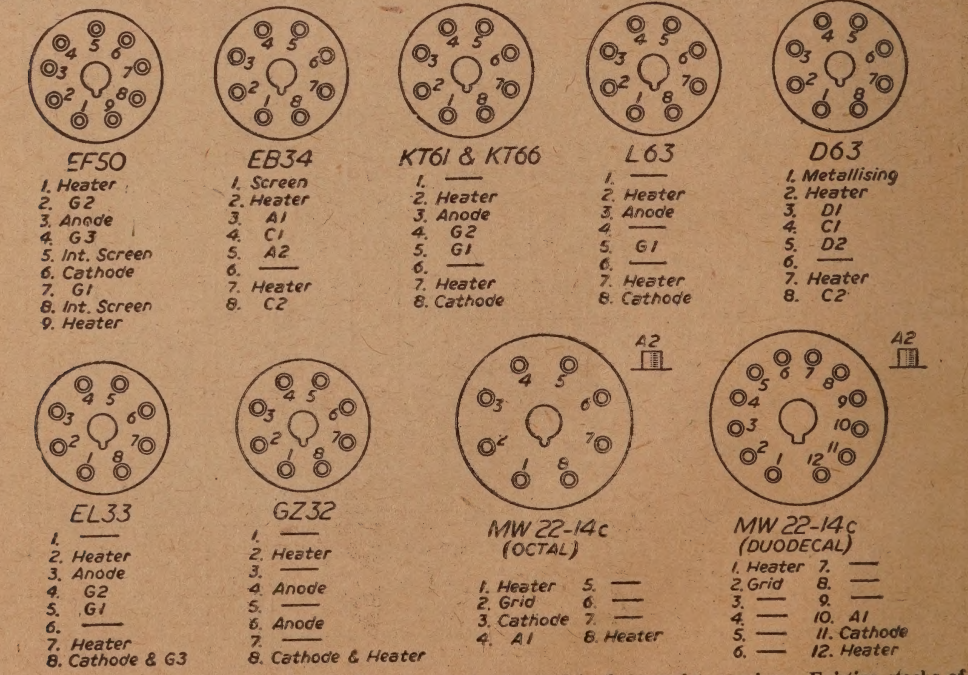


Fig. 7.—Details of valve bases for all the valves and tube used in the complete receiver. Existing stocks of the 22-14c tube are fitted with octal base, but this is being changed to the duodecal base. All views are of the valve or valveholder seen from the underside.

the top edge of the glass front and this holds the tube quite rigidly in such a position that the neck of the tube will be centred in the focusing mount. With some makes of tube it will be necessary to cut out a small piece in the side of the hole in the wooden support to clear the evacuating pip on the cathode-ray tube, but the modern duodecal tube has no such pip (it is actually inside the base of the tube) and, therefore, no cut-out is needed.

Power Unit

As mentioned last month the power unit incorporates also the output sound stage and loud speaker, and here is a view of the unit from the rear. On the upper surface of the chassis are the rectifier and output valves, two smoothing condensers, the mains transformer and the E.H.T. unit. Below the chassis is the smoothing choke, R44, and the output valve bias resistor and condenser. The front of the chassis is attached to a further wooden panel which is cut out to accommodate the loudspeaker and this panel may be made at this stage from the same material as the cathode-ray tube support—½in. plywood. It measures 10½in. by 14in. and the hole is 9in. in diameter, with its centre 8in. from the lower edge.

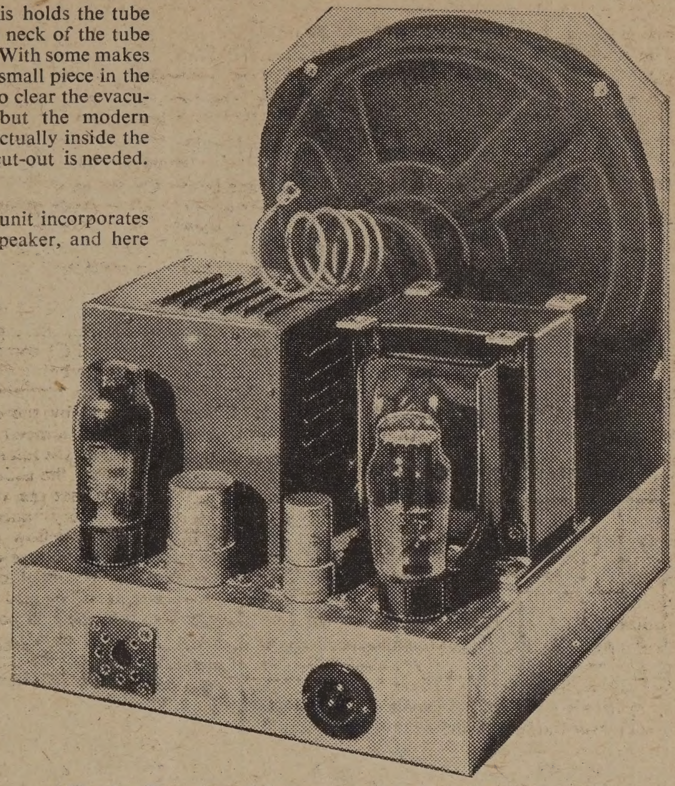


Fig. 6.—Rear view of the power unit and sound output stage.

Chassis

The chassis is made from the same material as for the main portion of the receiver and when finished measures 12in. by 14in. with 2½in. deep sides. The only really difficult part about the preliminary construction will be met with in this part of the installation. The mains transformer is of the type supplied with an insulated plate carrying soldering lugs for the various connections, and to reduce the lengths of connecting leads the original model was constructed by using the transformer upside down. To accommodate the soldering lugs on the transformer a piece has to be cut out of the chassis and this is irregular in shape.

(To be continued.)

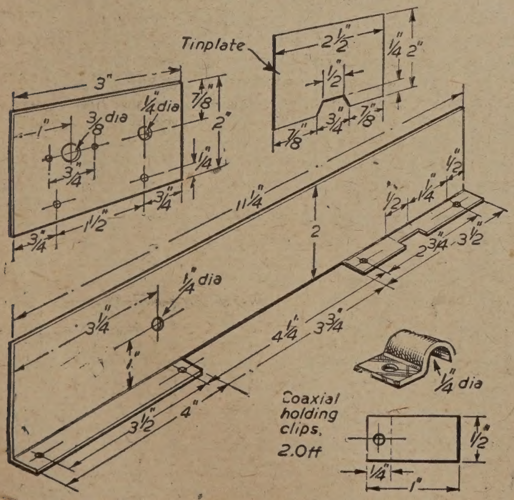


Fig 4.—Further screens and coaxial cable clips. All screens, with the exception of the upper right-hand one of this group, are in aluminium.

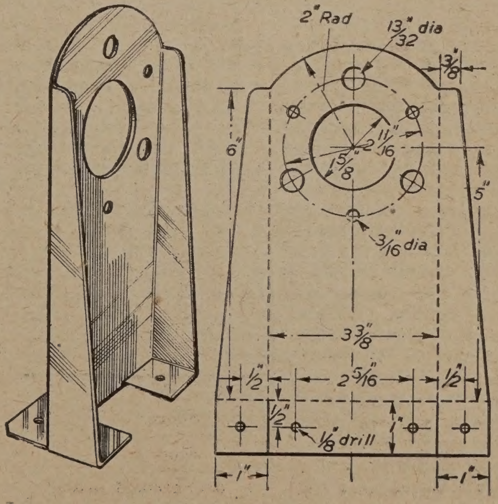


Fig. 5.—Support for the permanent magnet focusing unit.

Puckle Time-base and VCR517

Hints on Using this Circuit with Converted ex-Government Equipment

By D. CAVE

THE writer has been using the Puckle time-base with his home-built television receiver for about one year now and has found it to be very satisfactory. The time-bases are used to drive a VCR517 ex-Government cathode-ray tube using an E.H.T. of about 4,700 volts. The time-base H.T. supply is about 500 volts, and with the circuits shown as follows, each incorporating as an addition a one-valve see-saw amplifier, ample output is obtained to give a large picture on the tube, in spite of the high E.H.T. supply.

The circuit of this time-base is set out in Fig. 1. Three valves are used as shown. In the case of the frame time-base the writer uses all VR65 valves (triode connected for V2), whilst in the case of the line time-base he uses a 6J5 for V2, and the rest are VR65. In addition to this, each time-base circuit is coupled from the cathode of V2 via a condenser and resistance to a one-valve (VR65) see-saw amplifier (details of which were given in the first and second issues of PRACTICAL TELEVISION) to obtain push-pull scanning.

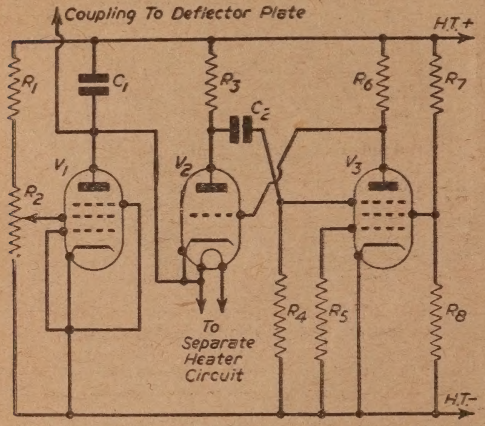


Fig. 1.—Circuit of the time-base referred to in this article.

Thus four valves are used for each time-base. This may seem somewhat prohibitive; but the writer considers that this objection is not a serious one in view of the excellent results obtained, and the fact that all the valves used are readily purchased quite cheaply now from ex-Government equipment. It may be noted at this point that VR91 valves may be used just as well here as VR65s.

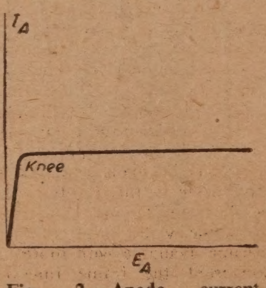


Fig. 2.—Anode current characteristic of a pentode.

Operation

The mode of operation of the time-base is as follows:

At the moment of switching on, the condenser C1 is uncharged, consequently there is no potential difference across it, and the bottom plate is at the same potential as the top plate. Now the bottom plate is connected to the anode of the valve V1, thus the anode of V1 is at the full H.T. potential, consequently, anode current flows and C1 commences to charge. The rate at which it charges being governed by the capacity of C1 and the resistance represented by the valve V1. The latter is governed by the screen voltage controlled by varying the potentiometer R2 whilst R1 is a limiter resistance to prevent the full H.T. voltage being applied to the screen-grid when the slider of R2 is at the top end.

Note that the valve V3 is connected as a pentode in the ordinary manner so that upon switching on anode current will flow through its anode load resistance R6 causing a voltage drop across this resistance; thus the anode potential of V3 is very much below the H.T. supply. The grid of V2 is connected to the anode of V3, so that the grid potential of V2 is the same as the anode potential of V3. R3 is of low value and the anode of V2 will be at about the full H.T. voltage. The cathode of V2, however, is connected to the anode of V1, and so on first switching on the grid of V2 is at a voltage very much lower than its cathode, that is to say, the grid is very negative compared with the cathode, consequently no anode current flows through V2 initially, and there is no voltage drop in the resistance R3. As the condenser C1 charges, the anode voltage of V1 will fall, because the anode voltage of V1 is equal to the full H.T. voltage less the voltage developing across C1. As the anode potential of V1 falls, so the cathode potential of V2 falls with it. Eventually the cathode potential of V2 has fallen so low that it approaches closely the potential of its grid. Immediately anode current commences to flow in valve V2 and a sharp voltage drop is produced at its anode due to the presence of R3. This sharp voltage drop is transmitted via the condenser C2 to the suppressor grid of V3 driving it negative and cutting off the anode current of V3. There is thus suddenly no loss of volts in R6 and the anode voltage of V3 rises steeply to the full H.T. potential, carrying the grid of V2 with it; thus the latter rises

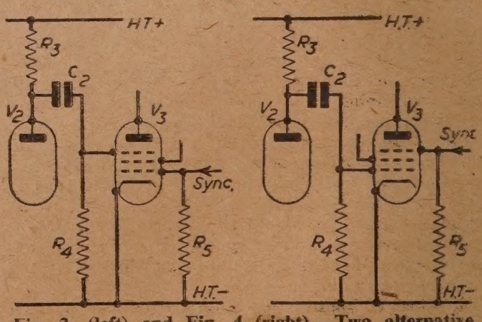


Fig. 3. (left) and Fig. 4 (right).—Two alternative circuits for introduction of the sync pulse.

rapidly positive with respect to its own cathode, causing a very heavy anode current to flow. This heavy anode current is drawn from the condenser C1 since the valve V2 is connected across C1. Thus C1 is discharged and the whole cycle of operation commences again.

The purpose of the valve V1 is to produce a constant charging current into C1. This is brought about by the fact that V1 is a pentode. The anode characteristic (Ia/Ea) of a pentode (as shown in Fig. 2) is almost flat above the knee; this means that no matter how the anode voltage changes the anode current of the valve will not alter appreciably; consequently the charging current from the valve into C1 is constant in spite of the fact that as C1 charges the anode voltage of V1 falls. The constant current into C1 causes a uniform rise of potential across C1 resulting in a linear scan. The speed with which C1 charges up to nearly the full H.T. voltage depends upon the anode characteristic resistance of the valve, and this may be controlled either by a variable resistance in the cathode lead or, as shown in Fig. 1, by varying the screen voltage. The resistances R1 and R2 should be so adjusted that under working conditions the screen voltage is kept low; this enables a linear-scan output of about 90 per cent. of the available H.T. voltage to be obtained. Reduction of the screen voltage produces an increase in the effective resistance of the valve, requiring a smaller value of C1 for the same speed of the time-base. The condenser C1 should not be made too small, however, especially in the line time-base circuit since the stray wiring capacitances in parallel with it may be a large total compared with it, and produce non-linearity.

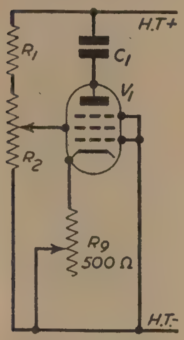


Fig. 5.—Simple linearity control.

Fly-back Time

In the explanation of the operation of the time-base it will be seen that V2 is the discharge valve, and the rapidity with which it performs its task largely governs the fly-back time. The anode resistance R3 is in the discharge circuit, and therefore prevents the fly-back from being as fast as it might, in consequence, then, R3 should be kept as small as possible without destroying the trigger action to V3. It will be seen that the cathode of V2 is fluctuating at sawtooth potential, so that it will not be possible to connect the heater of this valve to the circuit supplying the other heaters because one side of that circuit will almost certainly be connected to chassis and negative H.T. If the heater of V2 was so connected its heater-cathode insulation would probably break down at the peak of the scan voltage. A separate heater winding must be provided for this valve, and for the corresponding one in the other time-base circuit. The writer has not found this to cause any special difficulty, however, since it was quite easy to add an extra pair of heater windings to the mains transformer. Care was taken over the insulation of the windings and the leads to the valveholder; otherwise, no special precautions were needed. There might be some loss of sawtooth waveform at line frequency due to the capacitance to earth of the heater circuit; but there has been little evidence of this in action.

The valve V3 controls the extent of the scan through the voltage drop in the anode resistance R6, and this may be made variable if wished; but it should be noted here that R6 has an effect on the fly-back time, and should, therefore, be kept as small as convenient. The valve V3 serves a further function of being a suitable point to introduce the negative-going sync pulse. The sync pulse may be introduced either at the suppressor grid or at the control grid of this valve. Whichever grid is chosen, the other one will take the trigger pulse from the valve V2. The two alternative circuits are shown in Figs. 3 and 4. Try both of them to see which will give the best result in the circumstances in which the receiver is being used. In the writer's case the suppressor grid is preferred for injecting the line sync pulse, because noise on the pulse was found to be troublesome when using the control grid. In the case of the frame time-base, however, the control grid is used.

Non-linearity

In action some slight non-linearity was observed in the frame circuit; but this was easily remedied by applying negative bias to the valve V1 in the frame time-base circuit. This was done by introducing a variable resistance of about 500 ohms in the cathode lead of that valve, as shown in Fig. 5. Thus, if the anode current varies at all during the scan stroke, the grid bias voltage developed across the unbypassed cathode resistance will vary also, and in such a manner as to maintain the anode current at a steady value. By adjusting this resistance in conjunction with the screen resistance, an excellent linear condition was obtained without loss of scan.

LIST OF COMPONENTS IN FIG. 1

	LINE	FRAME
C1	.000 µF mica.	.05 µF 2,500 volt.
C2	.001 µF mica.	10,000 pF.
R1	100,000 Ω.	400,000 Ω.
R2	250,000 Ω.	25,000 Ω.
R3	1,000 Ω.	1,000 Ω.
R4	1 MΩ.	470,000 Ω.
R5	15,000 Ω.	1 MΩ.
R6	80,000 Ω.	300,000 Ω.
R7	56,000 Ω.	45,000 Ω.
R8	100,000 Ω.	100,000 Ω.

No difficulty has been experienced with synchronisation in the slightest degree, and there is no tendency for the time-bases to come out of lock when the receiver has been in continuous use for some hours. The setting of the time-base speed is not at all critical, and in point of fact it is found that even though the free-running speed of the time-base may be very different from the required speed; when the signal arrives the time-base locks in strongly; so much so that quite a large adjustment of the screen potentiometer on valve V1 does not upset the speed, but merely increases the extent of the scan until the picture splits or folds back with a portion very much enlarged. This condition may be very useful when adjusting the tuning of the vision receiver coils, because the frequency squares on the morning test card may be expanded considerably, enabling the bars to be seen more easily.

In conclusion it may be pointed out that the constructor need not be deterred from experimenting with this time-base by the large number of valves required, because a start may be made with the line time-base only, using the Puckle in this position and a Miller, for example, in the frame circuit. The writer had this arrangement for some while until another ex-Government chassis became available with more valve space on it, when he converted the frame time-base also to the Puckle circuit.

TELEVISION INTERFERENCE

The Cause and Nature of Some Common Forms of Interference

By S. A. KNIGHT

TELEVISION interference arises from a variety of causes and is particularly troublesome in those areas of low field strength lying beyond the reliable range of the present transmitters at London and Sutton Coldfield.

Much of such interference manifests itself as a result of nearby electrical appliances being poorly maintained, and little can be done about it apart from a direct appeal to the owners of the appliances to have their apparatus effectively suppressed. There is, however, considerably less interference present on the television frequencies from such forms of equipment than experience of their effects on the medium and long wavebands might lead some servicemen to believe. The reason for this is bound up with the nature and cause of such forms of interference.

Fundamentally, radio interference is caused by the discontinuity of the flow of current through a circuit. Whenever a switch is operated in a circuit or whenever a succession of intermittent currents due, say, to a sparking brush gear occurs, a momentary or transient current flows. This transient current may occur once as in the case of a switching on or off of some appliance, or it may occur at more or less definite intervals as in the case of the sparking brush gear. An analysis of the waveforms of currents of this nature reveals them as an infinite series of frequency components of differing relative amplitudes and falling rapidly in amplitude as the frequency increases. A faulty commutator contact

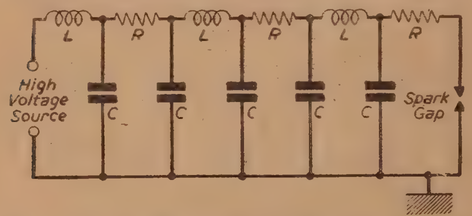


Fig. 1.—Equivalent circuit of the lead connecting distributor to plug.

may, for example, produce a series of current pulses occurring 500 times per second. These current pulses will be made up of components of 1,000, 2,000 and 3,000 cycles per second, and so on.

As the frequency increases the amplitude of the successive components decrease, and although components exist throughout the whole of the present transmission frequency bands, the amplitude of those components at 45 and 60 Mc/s is extremely small. Thus interference from domestic electrical apparatus is usually more pronounced on medium and long wavebands than in the wave length regions employed for television. This might be a poor consolation for those viewers who are plagued by domestic apparatus interference, but the fact remains (failing an approach to the owners and subsequent suppression) that nature is operating for once in the right direction.

Ignition Systems

As is so often the case, however, the falling off in electrical interference as the higher frequencies are approached is offset by the appearance of a form of interference almost unknown on the medium and long wavebands. This, probably the greatest single source of interference, comes from automobile ignition systems, which are a prolific source of short pulse radiation, and no one can be more aware of this than the owner of a television set who lives on or close to a main road in an area of relatively low field strength. Ignition effects are rarely noticed on normal medium- and long-wave receivers, with the possible exception of car radio sets. They become objectionable on short waves, particularly on frequencies above about 25 Mc/s, and an intolerable nuisance on television frequencies of 45 Mc/s and upwards. Unless the field strength of the received transmission is high, at least of the order of some 10 to 20 millivolts per metre, reception is almost certainly disturbed by vehicles passing within 20 yards of the aerial installation, and in the case of the particularly "bad" car, for distances up to as much as 100 yards and more.

The precise effect of this sort of interference on the received picture is worth a little study and is generally capable of being analysed in a more technical fashion than the usual "blobs and flashes." The effect upon the picture is that of the superimposition upon it of a great number of flickering spot areas, these sometimes appearing to lie in well-defined bands or strips across the picture, particularly when the offending vehicle is close to the aerial system. A careful examination of the interference areas generally reveals the spot as an elongated or fish-shaped patch of light, the actual length appearing to be a function of the intensity of the radiated interference. As the source of the interference recedes and the amplitude of the interfering pulses become less, so does the length of the light areas decrease, finally tending to the true spot and absorption into the normal line structure. It is of some interest that the brilliancy of the spot appears to change little during this area-diminishing period; the tube is, of course, being driven into peak white throughout the whole of the reception period of the interference.

There seems to be some difference of opinion as to the exact cause of the spot thickening during a pulse of received interference in addition to the lengthening effect described above. This constitutes the so-called "defocusing" effect of the interference. This defocusing is due, in the writer's opinion, to the momentarily increased density of the electron stream causing a mutual divergent action among the constituent electrons that cannot be corrected by the focusing magnet as then set. This view seems to be backed up by the fact that it is possible to adjust the focus control in receivers employing electro-magnetic focus systems so as to focus the interference (at the same time, of course, defocusing the actual picture). The writer has, however, had it put to him by someone not altogether without considerable technical knowledge that such defocusing is caused by a fall in the E.H.T. voltage due to a momentary increase in the tube beam current. This implies that receivers using E.H.T supplies of poor regulation (such as R.F. oscillator units) suffer more from the defocusing effects of car ignition interference than do those using

conventional mains supplies, which is not borne out in practice. While standing to be corrected on this point, therefore, the writer cannot accept this explanation as a good one and continues to stick to the previous theory. There is, of course, the possibility that the momentarily-increased voltage applied to the tube-control electrodes is high enough to cause variations of electron velocity in the beam ; since the amount of deflection depends upon the velocity of the electrons, then a beam composed of electrons having a range of velocities will suffer a corresponding range of deflections. The beam is thereby spread out into an eliptical cross-section with the major axis lying along the normal line direction of scan.

Sound Circuit

From the sound viewpoint the effect of the interference is that of the superimposition upon the audio signal of a machine-gun acoustic effect, and with a little experience it is easy to estimate the approach velocity or the acceleration or deceleration of a vehicle by the rapidity and volume of the noise. The ignition pulses are of extremely short duration, lasting for anything between 1 and 20 microseconds only, and having a very abrupt onset ; their peakiness is preserved by the wide bandwidth of the sound receiver circuits and the general attention paid by designers to maintaining a good frequency response in the early parts of their receivers.

Because of the extremely short duration of this interference it might be argued that it should not interfere on sound reception in any case, for no speaker will respond to pulses of such short duration, and this would be quite true if the interfering wave form was not distorted in any way by the receiver. It remains an unfortunate fact, however, that from the detector onwards the receiver circuits integrate the pulses into smaller amplitude, longer duration patterns with the result that the speaker responds to them normally. The tone of the noise thus appears low, and its general pitch is a function of the mechanical properties of the speaker, rather than of the shape of the applied pulse.

The precise cause of ignition interference and its nature are questions of some complexity, but in general a consideration of the ignition system used in cars can provide a reasonably feasible answer. Whether the sparking system is activated by a magneto or induction coil is of little importance, the same end-result obtains, that is, a succession of high potential sparks appear at certain definite intervals across the plugs of the vehicle.

The contributory factor in the appearance of the interference is the lead connecting the distributor to the plug. These leads are comparatively short physically, but electrically they must be regarded as lengths (sometimes quite a long length!) of transmission line having distributed capacity, inductance and resistance something after the fashion shown in Fig. 1. When a pulse of high voltage appears at the left-hand end of this line the current through the spark gap at the right-hand end is not a simple one-way affair, but is complicated by the presence of C, L and R along the connecting line. The result is a " ringing " effect and the spark consists of an oscillatory current of the form shown in Fig. 2. This oscillation is of an extremely high frequency and is quenched in a very few microseconds, but its peak amplitude might reach the extraordinary figure of 100 amperes or more. This figure puts to shame the peak current flowing in the aerials of the actual television transmitters !

This huge current flowing through the circuit represented by the distributed constants of the connecting lead radiates electromagnetic waves. On account of the high frequency involved a considerable amount of energy is thus radiated into space, this radiation being endowed with all the properties of the waves used for the actual television transmission. To make matters worse, these radiations are vertically polarised, and so they exercise the greatest influence upon vertical aerial arrays. If the B.B.C. transmissions were horizontally polarised so that horizontal receiving aerials could be used there would be a great reduction (probably as much as 6 to 1) in the strength of the received ignition interference under given conditions ; the American systems use horizontal polarisation and so (presumably) enjoy less trouble from cars. There are many pros and cons in this matter, however, which cannot be entered into at this stage, an important one being the difficulty of obtaining a uniform coverage around the transmitter site due to the directional characteristics of any but the most complicated aerial systems when horizontal polarisation is used.

Fortunately it is possible to suppress a car by the insertion of a resistance costing only a few shillings in the plug connecting lead, and in this instance nature is on our side. A problem which *might* have cost many pounds to remedy can be cured completely and effectively for a matter of shillings. Again, it is possible to design the

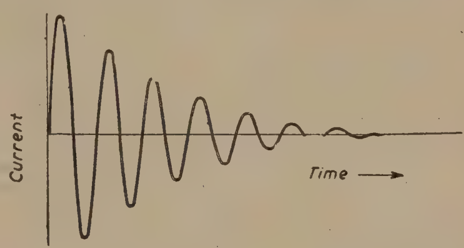


Fig. 2.—The damped oscillatory current wave appearing across the plug gap.

receiver to take care of much of this form of interference, and most manufacturers now include interference suppressors (or reducers is a better description) in the form of simple limiting circuits on both the vision and sound sides of their receivers. It is important to note, however, that these devices, while very effective against ignition interference, will do little or nothing against other forms of interference such as may be picked up from diathermy apparatus or harmonic radiation from the oscillators of badly designed all-wave superhet receivers.

Diathermy

Diathermy apparatus basically consists of a very powerful high-frequency oscillator ; this oscillator generates various frequencies for its curative effects depends on the fact that different parts of the body require different frequencies for effective treatment. The radiation from the diathermy oscillator is usually very high, but in general the effect of interference from such apparatus on television reception is limited to a range of only some few hundred yards at the most.

Unlike ignition interference the apparatus produces little or no effect on the sound circuits, and it is only the picture which is affected. The general appearance on the picture is that of a fine weave, herring-bone and check, this pattern sometimes covering the whole of the picture area, at other times being confined to a band or bands across the picture.

The interference radiated by badly designed all-wave receivers produces an exactly similar effect as that of

diathermy apparatus above, the root of the trouble in this case being the harmonics of the local oscillator employed in the receiver frequency changer.

Diathermy interference is most likely to occur in the vicinity of a hospital or clinical centre, but its suppression is another matter since the only effective answer is the complete screening of the whole apparatus (including the patient). Such screening is an expensive business and even the National Health Scheme is likely to jib at its universal inauguration. As regards the offending all-wave receiver, the only plan is to approach the owner (if he can be located) and try local screening of the oscillator circuits. A small choke in the aerial lead might effect an easy cure.

Prevention

As a final thought on this subject of television interference, there can be no doubt that the most effective solution is the one that prevents the interference from ever occurring. In spite of all the ingenious devices fitted by the set manufacturers, complete peace cannot come to the viewer so long as owners of offending apparatus—and this applies particularly to cars—are under no compulsion to suppress their machines. This is not a selfish view of the matter and the question of freedom of the individual to do as he pleases does not enter into the matter. It is to be hoped that the bill now before the Government will finally settle the problem to the satisfaction of everyone.

Stabilised E.H.T. Supplies

A New Idea for Obtaining Improved Regulation

THE form of high-voltage supply that is popular at present for cathode-ray tubes for television receivers is one using high-frequency oscillations generated either by a valve especially for the purpose, or by the line-scan generator of the receiver. This practice is followed for reasons of economy; to give but one instance, the problem of ripple filtering is greatly eased and smoothing condensers that are cheap, and also compact, may satisfactorily and conveniently be used by reason of the small capacities that are sufficient for smoothing ripple at such high frequency.

Against advantages of this kind there is to be set, however, a problem arising from the poor regulation liable to be obtained with E.H.T. supplies of this type. Due to high-regulation resistance, not only does spot size tend to vary with varying D.C. content of the picture but the picture size also tends to vary, and without adequate precautions the picture may swell noticeably when bright scenes are encountered and correspondingly shrink when the general illumination becomes low.

Various methods are available for overcoming these defects, but when stabilisation of some precision is demanded it is natural to turn to regulation as provided by the valve type of voltage stabiliser. Bearing in mind the very high potentials involved the most convenient of such stabilisers is the shunt variety. In Fig. 1 there is shown a circuit employing the shunt-valve principle, and the interesting feature about the circuit is the mode by which the shunt-valve is controlled. This valve and the cathode-ray tube are connected in what is often referred to as the long-tail pair manner. The connection is effected by the use of the resistor R common to both the cathode and grid circuits of the stabiliser valve and of the cathode-ray tube. The drive to the cathode-ray tube is applied at the grid electrode of the tube to modulate the intensity of the cathode-ray beam, and by virtue of the cathode coupling with the stabiliser valve the current in the stabiliser valve is simultaneously modulated. As the latter modulation is in inverse sense to the modulation of the cathode-ray beam and the stabiliser valve is in shunt across the cathode-ray tube, the variation in current drawn from the supply is reduced and by appropriate arrangement may be practically eliminated.

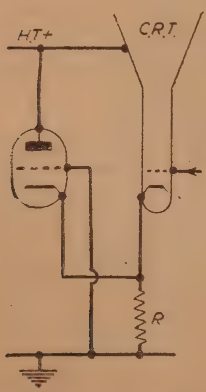


Fig. 1.—A shunt-valve circuit or long-tailed pair.

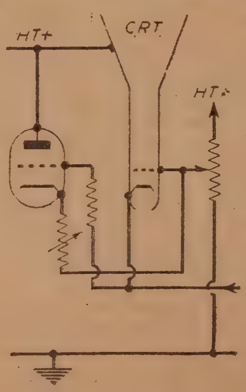


Fig. 2.—The improved circuit referred to here.

It will be realised that the presence of the cathode resistance R effectively extends the grid base of the cathode-ray tube so that cathode-ray tubes of short grid base are to be preferred in the circuit. A shunt-connected circuit in which there is no effective increase of grid base is shown in Fig. 2. Here, instead of applying the picture signal drive to the control electrode of the cathode-ray tube, the drive is applied to the cathode and a cross-connection is made between this electrode and the control grid of the stabiliser valve. The control electrode of the cathode-ray tube and the cathode of the stabiliser tube are connected to a source of bias potential by which means the grid biases of the two tubes are appropriately set up, and a resistance in the cathode lead of the stabiliser tube permits, by its variation, of the adjustment of the shunt circuit, so that variations of the current drawn from the E.H.T. supply on account of picture signal variations are reduced to a minimum.

Spares-box Television Receiver

A Simple but Efficient Sound and Vision Receiver from ex-Government Parts

By J. C. T. PRICE

THE great majority of readers of this paper are, like me, with very limited means at their disposal for their experimental work. By looking through your spares box and spending about £5 you may be able to indulge in a new field of experiment, for the results are well worth the trouble. A VCR97, mask, and lens were bought for 35s., 7s. 6d. and 25s. An RF25 unit was stripped for resistors, condensers, valves and choke (H.F.C.4). The rest was found in the radio spares box, or in the "ex-Government" spares box. The dipole was converted from an ex-Government 2 metre dipole (4s.) and copper tubing (1s. 6d.). At about 10 miles from Sutton Coldfield the signal may have to be attenuated.

Resistors

All values are multiples of 10 kΩ, 5 kΩ, 50 kΩ, 1MΩ of which the author had a surplus ex-Government—that is except the 30Ω and 350Ω which came from the RF25.

Condensers

Philips concentric trimmers are used for tuning—the RF25 has 15. Mica must be used where specified—otherwise tubulars will do. The author's other surplus was .01 μF. micas—.005 might do just as well. Five 0.01's were strapped to give 0.05 μF. mica.

Transformers

Normal mains transformers are used except for T_1. All are pre-war and have been in and out of various hook-ups. T_1 is an old intervalve transformer with generous core and about 4 : 1 step up—it is *not* metal cased. If an ordinary speaker and transformer are mounted on a lower chassis and the tube screened by the upper chasis there is no interaction.

Valves

SP61's were used because they were to hand. SP41's would do as well—4 v. heaters remember. The same applies to the P61. I was lucky in having a spare pair of 6SN7's. A 6H6 or a VR54 (which I have bought at the ridiculous price of 3d. !) will do instead of the VR92's—one-half the valve for each VR92, but is not quite so good. The P61 could be a 6C5, 6J5, etc. (octal).

Chokes

H.F.C.4 is from the RF25. The other can be replaced by resistors 1 k./5 kΩ. No choke was used in the V.F. stage although a choke of 85 μH i.e. Wearite PO2 minus coupling winding can be used here.

Chassis

The top is 18in. square, made by bolting up two old chassis with another mounted vertically on one end to carry time bases and tube holder. The lower chassis is also made up of two old ones bolted together.

Controls

Front panel

Brilliance. Focus. Contrast, volume. On/off. Tone.

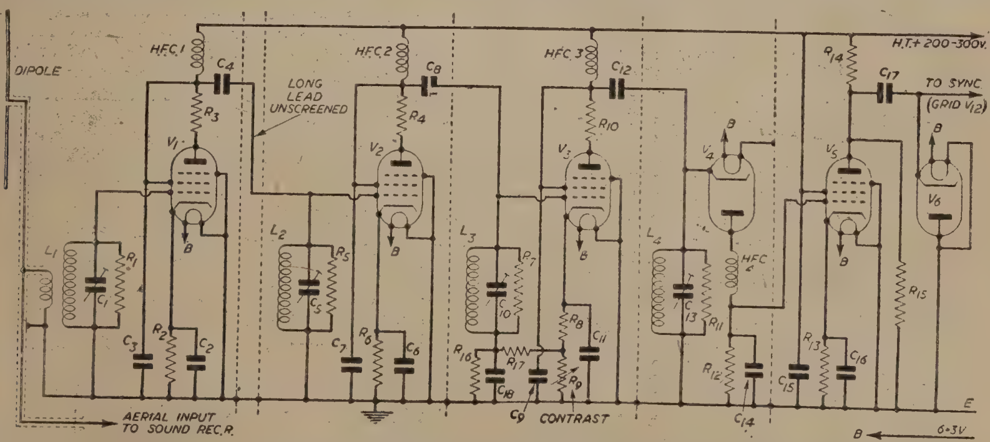


Fig. 1.—Vision receiver. If it is desired to have the contrast control (R9) on the front panel, it would be desirable to transfer it to V2.

C1, C5, C10, C13=Phillips concentric trimmers.
C2, C3, C6, C7, C9, C11, C14, C15, C16=0.01 μF.
C4, C8, C12=100 pF. mica.
C14=10 pF. mica. C18=.005 μF.
C17=0.1 μF. or 0.01 μF.
R1, R3, R4, R5, R7, R10, R11, R12=5 kΩ.
R2, R6, R8=350 Ω.
R13=30 Ω. R14=2.5 kΩ.
R12, R16=50 k. R9=10-15 k. pot.
R15=1 MΩ. R17=20 kΩ.
HFC1, HFC2, HFC3=pile-wound SWCs 5mH. or resistors 1 k.-5 kΩ.
HFC4 from RF25 unit or approx. 1in. CW 30-36 s.w.g. c.c. on ⅜in. former.
V1, V2, V3, V5=SP61.
V4, V6=VR92, or one 6H6, etc.
L1, L2, L3, L4 (see text).

Accessible

Line hold (fine). Frame hold (fine) at top.

Preset

Line hold (coarse). Frame hold (coarse). X shift. Y shift. Frame amplitude and line amplitude (height and width). In wiring, line coupling condenser (C_4) to be set and sealed.

E.H.T.

Uses an old intervalve transformer (see paragraph one). If full scan is not obtained reduce E.H.T. or turn C.R.T. through 45 deg., changing deflector plate connections. Do not adjust when connected to mains or you may be lucky enough to regret it! The author's set has a 3-way cable with chassis, etc., automatically earthed on inserting plug.

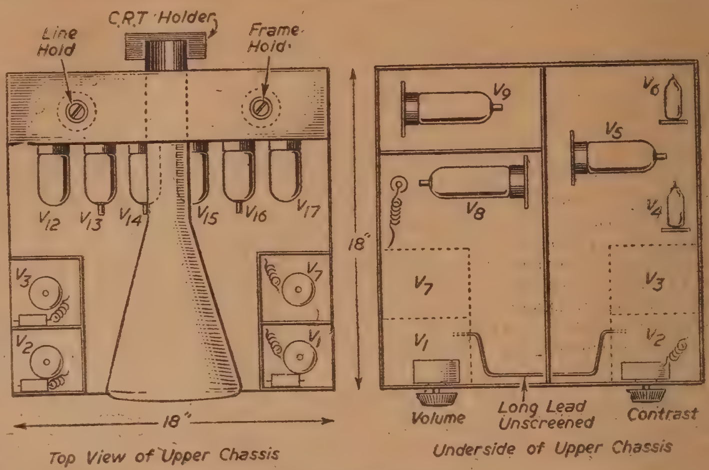


Fig. 2.—Top and underside chassis views.

Lining Up

Although a home-constructed pattern generator was to hand it was not used, the whole idea being to make a set which the barest equipped amateur could build. No doubt such instruments do produce better results—so if you have one use it; if not, follow these instructions. Incidentally, the only aids to construction were a home-made A.C./D.C. meter (up to 2.5 Kv. A.C./D.C.) and a book of ABAC's—and time.

Connect phones to C_{33}/R_{30} and earth; adjust trimmers and/or open or close coil turns for maximum signal. Repeat for vision receiver with phones connected at cathode of V_6 and earth. Render time bases inoperative and turn up "brilliance" until a spot just appears on the screen. Rotate "focus" control for minimum size. Centre by moving "X" and "Y" shifts. Bring in time bases and a series of dark bars will be seen. Rotate R_8/R_9 until bars straighten and disappear. Adjust R_{33} (line hold) just to fill screen. Adjust R_{21}/R_{22} until one picture holds or locks. Adjust R_{23} to screen size until the tuning pattern circle (or picture proportions are correct). If the picture tends to pull out at top adjust C_4.

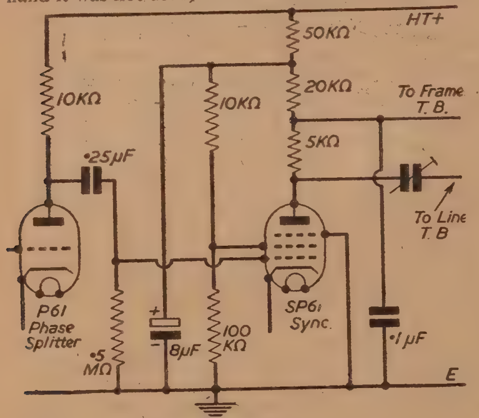


Fig. 3.—Alternative phase splitter section.

Coils

16 gauge copper, bare.

Wound on a 2" former and slipped off. Solder direct to wiring.

C20, C25, C28=Phillips concentric trimmers.
C21, C23, C24, C26, C30, C35 =.01 μF. C19=15 pF.
C22, C29=100 pF. C27=200pF
C31=300 pF. All mica.
C33=0.1 μF. C34=1 μF.
C32=0.25 μF.
R19, R23=350 Ω. R27=½ MΩ.
R18, R20, R22, R24, R21=5 kΩ. R28=1 kΩ.
R26, R29=50 kΩ. R25=100kΩ.
R30=½ MΩ pot.
R31=15 k. 3 w. R32=470 k. 3w. (or others to drop H.T. to requirements).
V7, V8=SP61. V9=EBC33.
L5, L6, L7 (see text).
HFCs (see Vision RX).

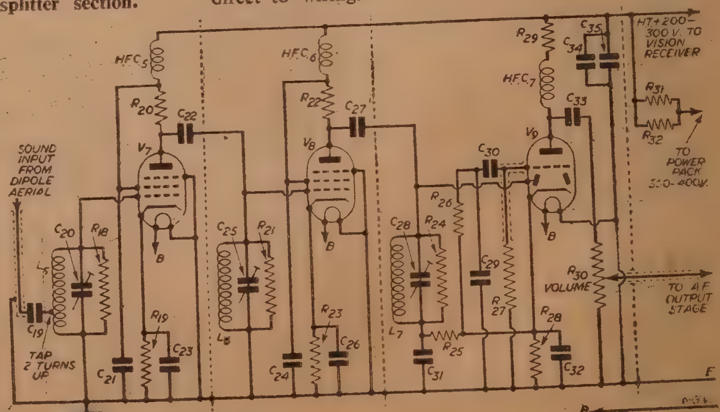


Fig. 4.—Sound receiver section.

L_1 (vision) 6t tapped 2t. L_2, L_3*, 4t, L_1 5-6t.
L_5 (sound) 7t tapped 2t. L_6, L_7, 6t.

Some experiment may be required here due to stray capacities. All coils may be 8t and turns soldered together if too large, this saves rewinding or cutting.

Spacing about 1 turn thickness.

Coupling coil. Self sup. (insulated) interwound grid end of L1.

Suggested Improvements

The finer points and improvements must be left to the individual. The chokes can be replaced with 1k to 5 kΩ resistors, but RFC4 should be about 250μH.

Stray capacities in the V.F. stage are important. The anode of V_4 should be connected direct to the grid of V_5, and the cathode of V_6 as near the coupling condenser C_{17} as possible. V_5 (SP61) with a 85 μH boost choke has been calculated to pass 2.5 Mc/s. The vision receiver response may be improved by using 2.5 kΩ damping resistors, though this reduces gain; this is best tried by adding a further 5 k resistor to R_1, R_5, R_7 and R_{11}.

Long Distance Reception

Use the best aerial you can. It may be possible to tap the aerial straight on to the main coil of L_1, about 1½ turns up (and may possibly require another turn to L_1). If another R.F. stage is added instability may result; whether this is so or not will depend upon the smoothness of the power supplies, and eddy currents. If you are going to try this, use common earth points for each stage, but remember the set is not

*3t if large capacity "loss" due to "long lead."

C2, C6, C15=8 μF. (elec.). C4=30 pF. (var.).
C10, C11, C16, C17=0.1 μF., 2,000v. D.C.W.
C3, C13, C18=0.05 μF. (mica).
C1, C7, C9, C14, C18, C19=0.1 μF. C12=.01 mfd.
C5, C8=100 pF.
R1=5 K. or 10 KΩ (according to signal input to C.R.T.).
R6, R28, R29=1 MΩ. R14, R15=2 MΩ.
R5, R11, R12, R31, R16, R17, R26, R27, R18=50 KΩ.
R7, R24, R27=100 KΩ. R4, R19=20 KΩ. R5=5 KΩ.
R2, R3, R7, R32=10 kΩ. R10, R20=½ MΩ.
R23, R33=50 KΩ pot. R8, R9=1 MΩ pots. *or* one 2 MΩ pot.
R21, R22=1 MΩ pots. *or* one 2 MΩ pot.
V12=P61.
V13, V14, V16=SP61.
V15, V17=6SN7.

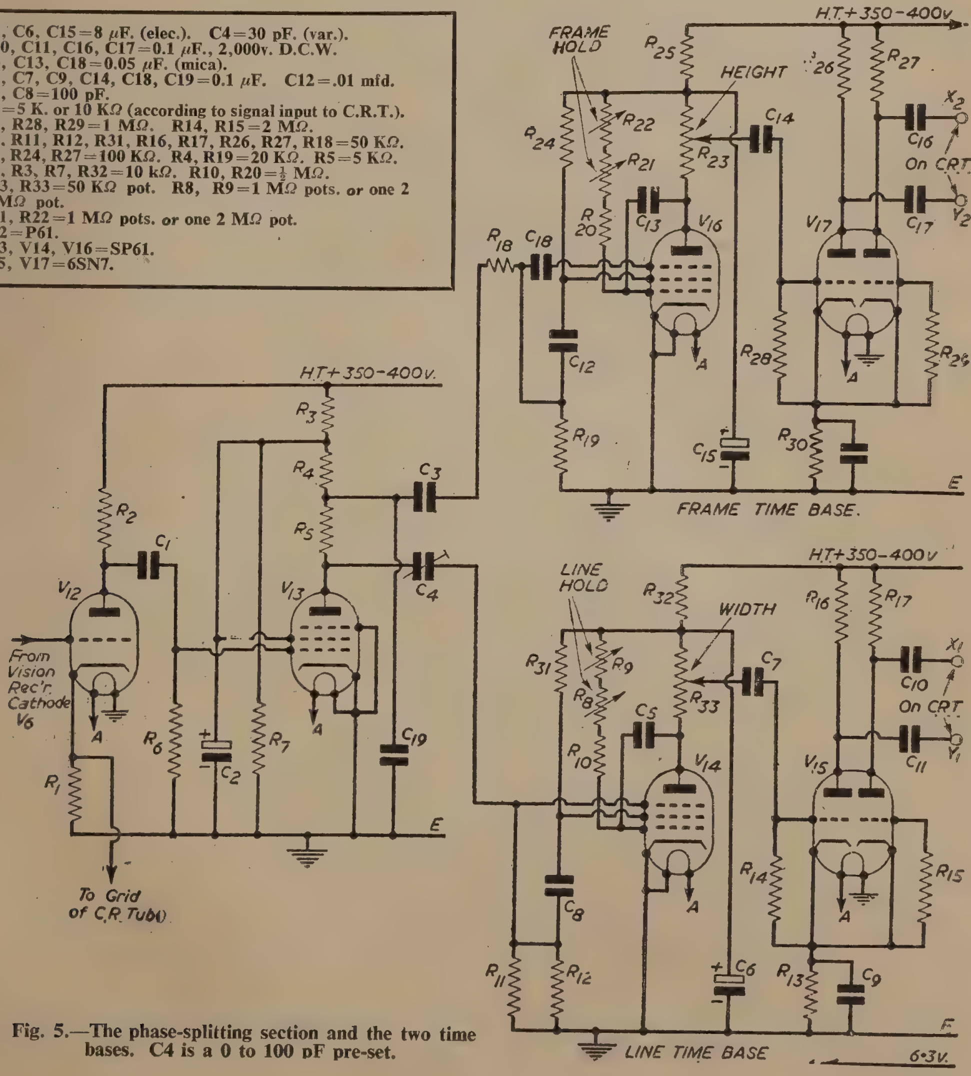


Fig. 5.—The phase-splitting section and the two time bases. C4 is a 0 to 100 pF pre-set.

fitted with any sound or vision suppressors. Remember also that the SP61 is very greedy on heater current—0.6 amps. each !

Rejectors

If it is found that in your particular locality it is not possible to obtain sufficient selectivity to cut out sound breakthrough on the vision channel a simple suppressor coil may be included in the input circuit. Fig. 8 shows a practical layout for this particular coil from which it will be seen that it is made up exactly on the same lines as the remaining coils, and consists of 6 to 7 turns. It is also self-supporting and is connected in Stage 1 in the usual manner. It may be found that the best position is in series with the cathode biassing components R2 and C2. Whether it is best on the cathode or the earth side of these items depends upon the rest of the layout, and the coil is, of course, tuned to the sound frequency.

Even if you have never experimented with television before you will know quite a bit after getting this going.

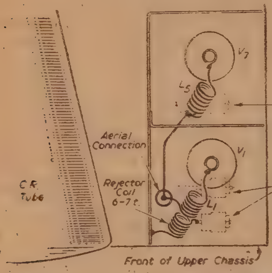


Fig. 8.—How to add a rejector coil.

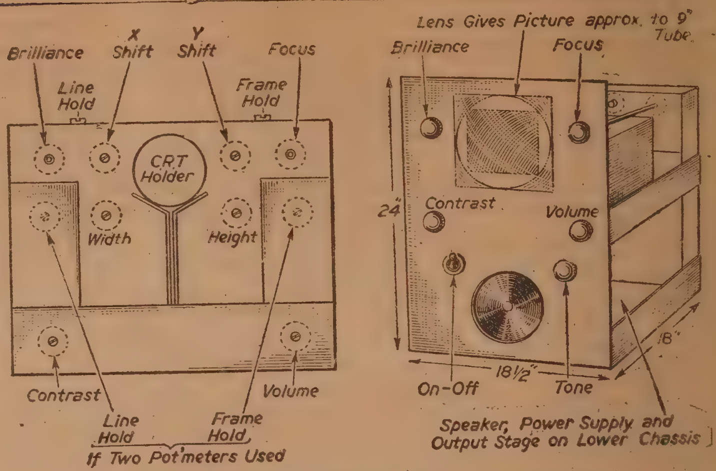


Fig. 6.—Front view of upper chassis and general layout.

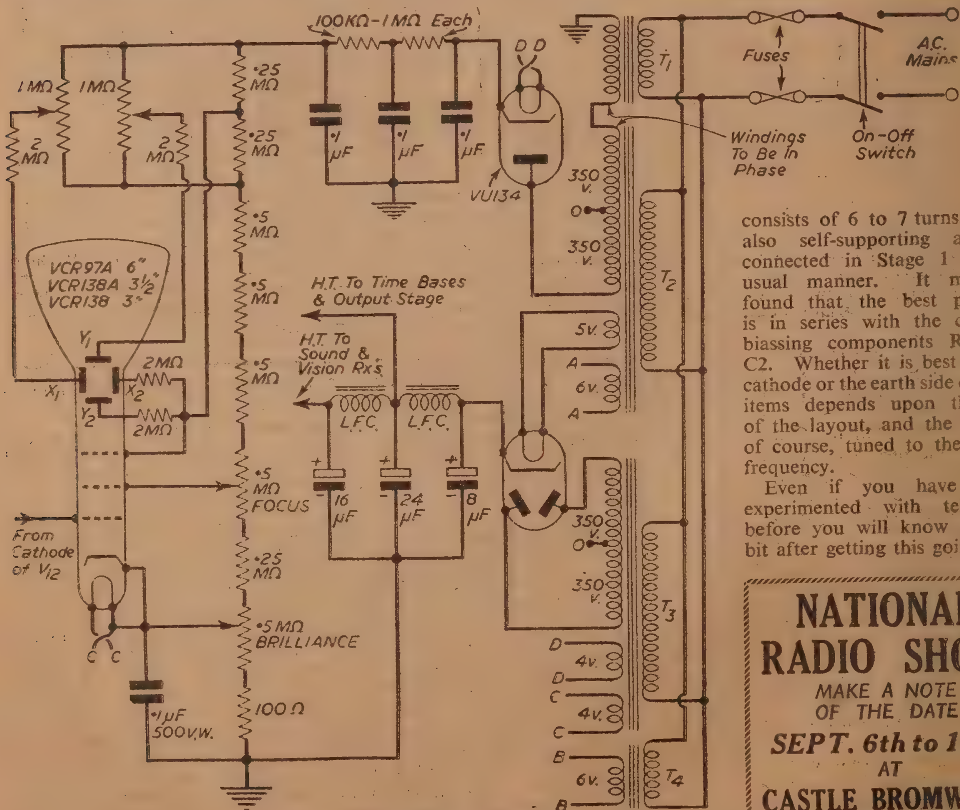


Fig. 7.—Tube and power supply. If the tube will not focus, remove or add one .5 MΩ resistor in the Brill./Focus resistor chain.

Servicing Television Receivers—5

How to Locate Faults and Cure them in Commercial and Home-made Equipment

By W. J. DELANEY (G2FMY)

THE time-base in general will consist of an oscillator (either hard valve or gas-discharge tube) followed by an amplifier. It is thus possible for practically all of the major faults of television reception to arise in these stages, and they are the hardest to locate unless a cathode-ray oscilloscope is available. It has been shown so far that faults in the vision or sound receivers are very easy to trace owing to their giving a clear indication on the received picture. Synchronising faults also are fairly clearly indicated, although, depending upon the complexity of the sync separator the exact location of the offending component may take some time to trace. On the other hand, a fault such as a cramping of the picture on one side or another may be due to inaccurate values of a component in a time-base which ordinary testing will not locate. For instance, in the P.W. television receiver, which utilises a hard-valve time-base for both circuits, and both of which are of the blocking oscillator type, the use of a length of ordinary 5-amp. lighting flex to feed the line coils from the output of the line time-base will result in a cramping on the right (or an opening out of the left) over which adjustment of the linearity control will have no control. In most line time-bases, irrespective of the particular circuit employed, undue capacity in the leads to the line coils will cause a modification of the rate of scan and give this form of picture distortion. Therefore, use leads as short as possible here, and use two separate leads.

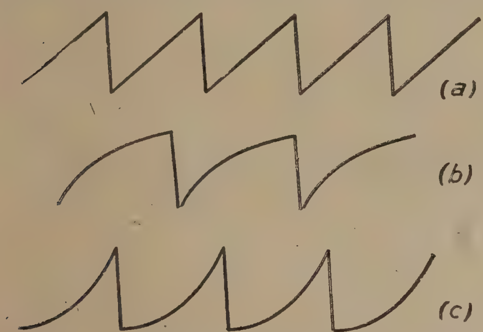


Fig. 1.—At (a) is seen the required saw-tooth waveform. (b) shows the exponential form of a condenser charging or discharging circuit, and (c) the waveform of an over-biased L.F. valve. Combination of (b) and (c) should produce (a).

Whilst on the subject of the linearity of the picture it is interesting to note that in the P.W. receiver full control is available over all four quarters of the picture. Line linearity or form will enable the left-hand side to be brought to balance the right (on the test card), and as the amplitude control is adjusted to fill the raster, any corresponding closing on the left is adjusted by the form control to keep both halves equal. Similarly, the height control will be found to operate more on the lower half of the picture, and the balance is maintained with the frame form control. Not all circuits operate in this way, of course, but within the range of adjustment provided by the designer of the set there should be ample control—if not, there is a fault in the circuit, and this is rapidly identified with an oscilloscope.

T.B. Amplifiers

Provided that the oscillator is operating, the most likely cause of trouble is in the amplifier feeding the coils. This amplifier does not always operate on the same lines as a normal L.F. amplifier or output valve. The oscillator, in general, will provide an exponential type of output—especially the gas-discharge tube circuit, and to correct this, the amplifier is sometimes biased to provide an opposite form of distortion, the two cancelling out. Obviously this calls for critical values. In most time-bases, some form of negative feedback is incorporated in the amplifier stage, and again, this is an arrangement which calls for exactness in working characteristics. In general there will be a condenser feed to the grid of the amplifier valve, and if this is leaky, a positive bias may be applied to the grid to introduce trouble.

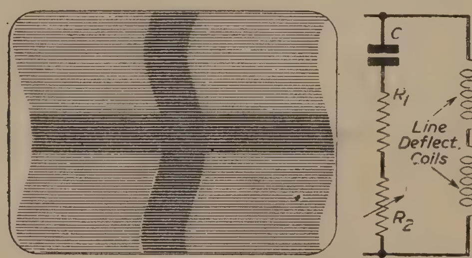


Fig. 2.—On the left is the effect produced by hum in the time-base circuits. On the right is the line-deflection coil and a common form of linearity or form control. Either R1 or R2 or both may be variable, and in some cases C also is variable.

Somewhere in the amplifier stage—generally across the line coils, will be found an R.C. network introduced for the purpose of straightening out the inherent kinks in the output characteristic, and labelled Linearity or Form. Obviously, again, a leaky condenser will cause trouble which cannot be remedied by the adjustment of the resistor (which may be variable) in this stage.

From the foregoing it will be seen, therefore, that for quick location of faults in the time-base a tester which will check condensers is almost a necessity, and failing this substitution methods will have to be adopted. Another difficulty with this part of the circuit is that troubles can only be seen when there is a transmission being received and consequently if fault finding here is to be undertaken outside of broadcasting hours an artificial picture must be provided, and an instrument known as a pattern generator must be employed. If only the frame time-base is faulty, however, an ordinary signal generator may be used, as this provides horizontal bars which should be evenly spaced—the number of bars depending, of course, on the frequency of the modulation circuits of the generator.

Focus

A point to be mentioned at this stage is that of focus in those circuits—mainly ex-Government sets—in which push-pull amplifiers feeding an electrostatic tube are employed. Both valves (or both halves where a double-triode is used) must operate equally, but if they do not, then one side of the picture may be found sharp and clear whilst the opposite side is apparently defocused. Some difference in brilliancy is also noted under these conditions, and this point should also be borne in mind with other circuits. The rate of travel of the spot will, of course, affect the brilliancy. If the spot travels very fast the line formed will be much darker than when the spot travels slowly, although in general this may result in picture distortion. Where, however, a linearity control has been adjusted to "distort" the picture to make it appear correct, the difference in speed of travel will still leave this uneven brilliance.

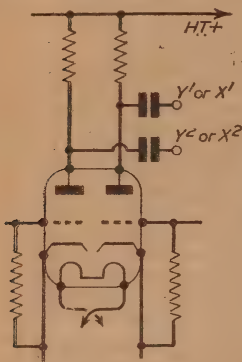


Fig. 3.—Push-pull operation of the X and Y plates of an electrostatic tube depends for good linearity on exact balancing of the characteristics of the push-pull valve or valves.

External Influence

It is important to bear in mind at this point that, although the time-bases are primarily responsible for the shape of the raster, the latter may be distorted by external magnetic fields. A mains transformer, for instance, situated too close to a tube will bend the beam—a fact which has been utilised in American equipment to prevent ion burn on the tube. The electron gun assembly in the tube has been bent and a small magnet is clamped round the tube to bend it back so that it produces the raster on the tube face, but the heavier parts of the beam which result in the ion burn are thus kept off the screen. Mumetal screens can be used round the smaller ex-service tubes, but should not be added to a published design unless the full implications of such change are understood.

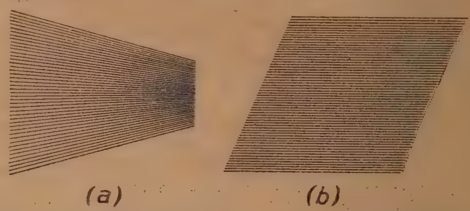


Fig. 4.—Distortion of the above forms may be due to defects in the scanning system, but is often caused by external magnetic fields such as transformers, loudspeaker magnets, etc.

Hum

One final point on the general faults of the time-bases should be mentioned here. Apart from "shape" distortion due to faults there is often experienced a bending of verticals which is not steady. Thus, if, for example, one is receiving the artificial bars signal (the black cross which often precedes a normal transmission) this may be found to wave slightly, like a flag in the breeze. Although this is somewhat similar to the effect produced by sound impulses in the vision channel, it cannot be the case here, as no sound accompanies the artificial bars, and the most likely cause is inadequately smoothed H.T. to the time-bases —not the vision channel. If the receiver has been operating satisfactorily and the trouble has developed, the most likely cause is an open-circuited H.T. smoothing or decoupling condenser, or a disconnection to it.

Three New Television Receivers

E. K. COLE, LTD. announce the release of three new Ekcovision receivers—Models TC138, TRC139 and T141—incorporating many of the features of last year's popular range, but including *superhet* circuits and housed in very attractive re-styled cabinets.

The following are the brief descriptions of these models showing the main differences, and this is followed by a full description of Model T141, the main television features of which are common to all three receivers.

Model TC138.—A 12in. tube Console receiver with superhet circuit—a modernised version of last year's popular TSC102—with 8in. moving coil, high-flux density-type speaker. Price: 62 gns., inclusive of P.T.

Model TRC139.—A high quality 12in. tube Console with four-station pre-set radio unit. A re-styled and modernised version of last year's Model TRC124, with the additional advantages of a superhet circuit; 8in. speaker. Price: 72 gns. inclusive.

Model T141.—A 12in. table Model with superhet circuit and 6in. speaker. Price: 55 gns. inclusive.

Midland versions of the above receivers will also be available—Models TC138B, TRC139B, and T141B.

MODEL T141

This table model is a re-styled and modernised version of last year's popular TS114 incorporating all the proved features of this model with the additional advantages derived from the superhet circuit.

The aerial input circuit of the R.F. stage is designed to match an 80-ohm coaxial cable. The receiver may be tuned to any of the five channels by a competent engineer by the adjustment of the three R.F. coils and the oscillator. The I.F. stages are arranged to give optimum bandwidth with adequate sound rejection, thus ensuring excellent picture quality.

The vision spot limiter is a two-stage device. The constants of the first stage are adjusted so that small amounts of ignition or similar interference are by-passed without any appreciable cutting of the peak whites, and the limiter will follow the modulation level and give correct suppression at all times. There is, therefore, no need for an adjustable control for different viewing levels. The values of the second stage have been chosen to deal with much heavier interference and may be selected at will, thus ensuring a minimum of distortion of the picture combined with a maximum of spot limiting.

Television Aerials–Indoor or Outdoor?

R.E.C.M.F. and B.R.E.M.A. Advice

IS an external television aerial really necessary? Fundamentally, that is the question which is causing concern to municipal authorities and others who, as landlords, are anxious to avoid them on their properties if possible.

Although the rapidly increasing number of aerials springing up throughout the areas served by the television service can be regarded by the more philosophic as signs of the times in which we live, it cannot be denied that the more conspicuous types do not lend enchantment to the view. It is natural, therefore, that those responsible for individual properties or for the preservation of the amenities in districts under their control, are inclined to regard this growth with some disquiet.

On the other hand, it is equally natural that the owners of television receivers should be anxious to ensure that they derive the fullest possible benefit from their initial outlay and, in consequence, tend to favour external aerials of the larger kind on the assumption, rightly or wrongly, that they are essential for best results. "Why spoil the ship for a ha'porth of tar?" seems to be the attitude of many to the extra cost of these outdoor aerials.

Unfortunately, differences of opinion on their necessity or otherwise have led to disputes between landlords and tenants. In some cases the former have banned external aerials, or have laid down such onerous restrictions that their erection has been discouraged. The following details will show that there are many factors which must be taken into consideration before the type most suitable for any particular building or district can be decided.

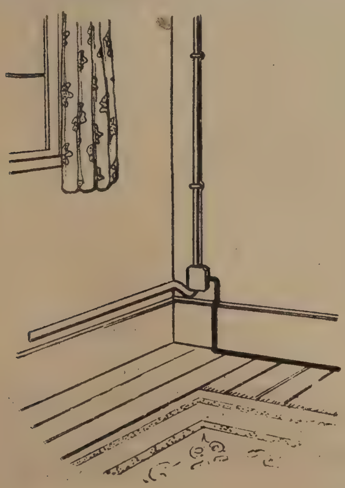
Already, with only two stations operating, the popularity of television is enormous. As the service extends throughout the kingdom, so the demand for receivers—and, incidentally, aerials—will increase. Indiscriminate discouragement of this inevitable development can only be shortsighted policy. For, undoubtedly, the time is not far distant when television receivers will be as common in the home as radio sets to-day and, like radio, will come to be regarded as an essential service on a par with electricity and water supplies. That this has been recognised by many municipal authorities is apparent from their requests for advice on the provisions for television in plans for long-term building projects.

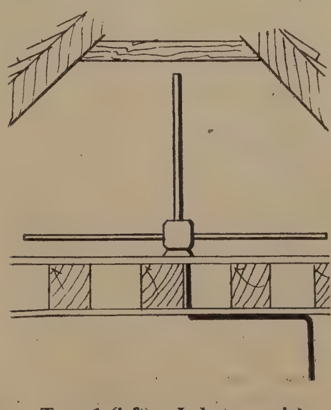
Apart from the fundamental question of outdoor v. indoor aerials, there are numerous others complementary thereto which are frequently raised by property owners. What are the relative merits of the various types of aerial available and what considerations determine their selection? What is the most practical method of equipping blocks of flats with television facilities?—these are typical of such enquiries.

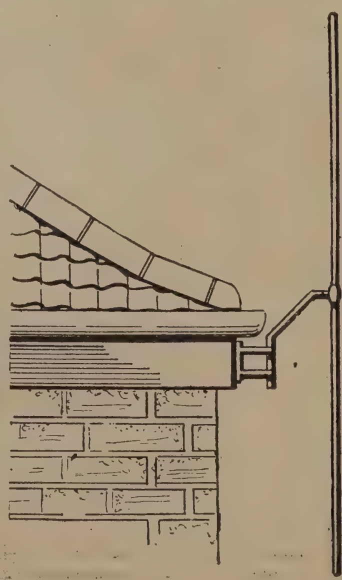
That there is a general need for accurate guidance is, therefore, apparent. It is hoped that the following information will prove of assistance to those who own or intend to own television receivers; to the dealers supplying these receivers and aerials, and to municipal authorities and other property owners on whose judgment the choice of aerials to be used by their tenants ultimately lies.

Basic Factors

To obtain the fullest enjoyment, television reception depends on two factors: adequate signal strength and freedom from electrical interference. It is desirable, therefore, to give some explanation of the circumstances which govern these before dealing with the functions of the various types of aerial.







Type 1 (left).—Indoor aerial.
Type 2 (above).—Loft aerial.
Type 3 (right).—Simple dipole.

The Signal

For the purpose under review, there is no necessity to go into the technicalities of television-wave behaviour. It is sufficient to say that the waves radiate from the transmitter in a similar way to those formed by a stone when thrown into still water: the nearer the stone (or transmitter), the more pronounced the waves, which grow less and less discernible as the distance from their source increases. They can be compared also to rays of light in that they are reflected or reduced in strength by intervening objects to a greater extent than the much longer waves used for radio broadcasting. For these and other reasons the strength of signal received depends on:

(i) The distance between the transmitter and receiver.
(ii) The contours of the intervening country.
(iii) The relative heights of the transmitting and receiving aerials.
(iv) The construction of the building housing the receiver (e.g., steel-framed, plain brick, etc.).
(v) The presence of large structures in the vicinity of, or which overshadow the receiving site (e.g., large buildings, gasholders, etc.).

Interference: Cause and Effect

The type of interference most frequently encountered is that caused by electrical impulses generated by various domestic appliances, electro-medical or industrial equipment and by the ignition systems of motor vehicles. The last mentioned is by far the most prevalent owing, of course, to the number of vehicles in use. These impulses are radiated in precisely the same manner as the television waves, and can cause white or black patches, patterns or other forms of distortion to appear on the television screen which may, in severe cases, completely obliterate the picture. The reception of sound is also affected, producing crackling noises which may be so severe as to ruin reception. Another form of interference, which is caused by the nature and disposition of surrounding buildings or land, is that which takes the form of multiple images on the screen, commonly known as "ghost images." Thus the prevalence and strength of interfering signals depend on the following factors:

(i) The extent and proximity of motor vehicles and/or air traffic.
(ii) The extent and proximity of electrical equipment used in the locality of the receiver.
(iii) The nature and disposition of surrounding buildings or land.

From the foregoing it will be appreciated that the number of combinations of signal strength and interference factors can be considerable. The most important aspect is the relative strength of the television signal compared with that of the interfering signals. Interference which is of sufficient intensity to spoil reception where the television signal is weak may have little or no effect where the latter is strong. The weaker the signal the less the degree of interference that can be tolerated.

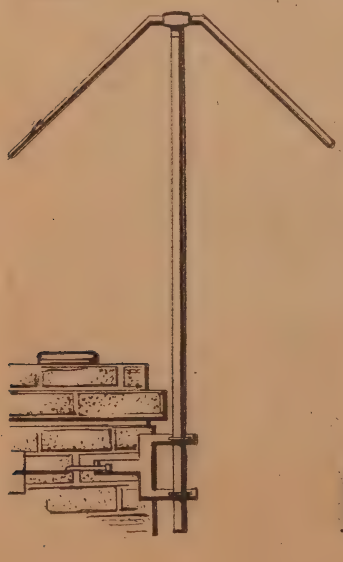
Choice of Aerial

There are types of aerial available to meet most reception conditions. They fall roughly into two categories, non-directional and directional.

Non-directional aerials respond equally to signals coming from all directions; directional aerials are more sensitive in one or more particular directions according to their design. For this reason the latter are used when it is necessary to reduce interference received from directions other than that of the desired television signal. Generally, they provide greater signal strength than the non-directional types, thus improving the relative proportions of signal and interference. Even if the sources of interference are located on all sides of the receiver these types still reduce the interference from behind, thus giving some improvement, whereas the non-directional types, such as the single dipole, have no such properties. It is for this reason that it is sometimes necessary to erect a directional outdoor aerial in strong signal areas even near the transmitter.

The type of television aerials now commercially available can be classified as follows:

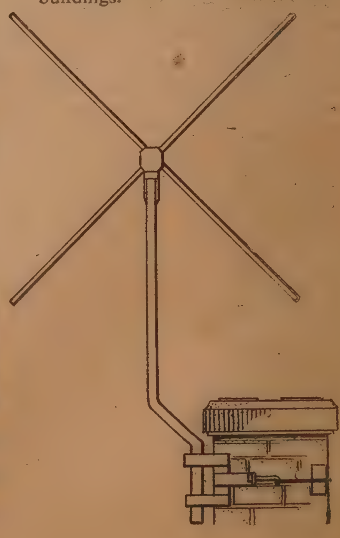
Types of Aerial	Properties and General Remarks
1 — Indoor Aerial (fitted in same room as, or integral with the receiver).	Reception may vary from room to room and house to house. The picture may be affected by persons moving in the room or by the presence of other indoor aerials fitted in the same building. Generally unsuitable for steel-framed buildings.

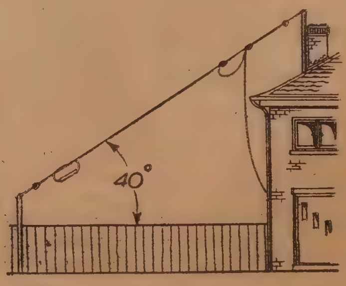


Type 4 (left).—Inverted "V" which is also suitable for use in a loft.

Type 5 (below).—Tilted wire.

Type 6 (right).—The "X" form aerial.

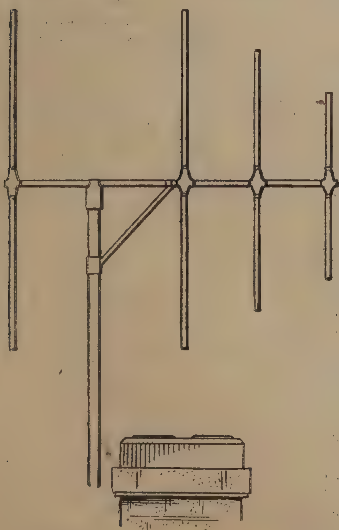




2 — Indoor Aerial (fitted in loft).	Some types of loft aerial have directional properties which assist in reducing interference.
3 — Single Dipole Aerial (mounted outdoors).	Reception will depend largely upon the position and height of mounting. The optimum position may vary even with similar buildings situated near to one another.
4 — Inverted "V" Aerial.	Possesses certain directional properties which can be used to reduce interference.
5 — Tilted wire Aerial.	A long wire aerial of highly directional properties which requires space for erection.
6, 7—"H" or "X" Aerial.	This type is directional and must be oriented according to the site. Reception will depend largely upon the height at which it is mounted.
8 — Multi-element Aerial.	Highly directional for weak areas, must be mounted as high as possible.

Wide experience has shown that reception conditions for which these types are generally suitable are as follows :

Reception Conditions		Type(s) of Aerial
Signal Strength	Interference	
Very strong	Slight	1, 2 or 3
Very strong or Strong	Moderate or Slight	2, 3 or 4
Moderate	Moderate	4, 5, 6 or 7
Very strong Strong Moderate or Weak	Severe or Moderate	5, 6 or 7
Very weak	Slight	8



Type 8.—Multi-element aerial.

Method of Fixing

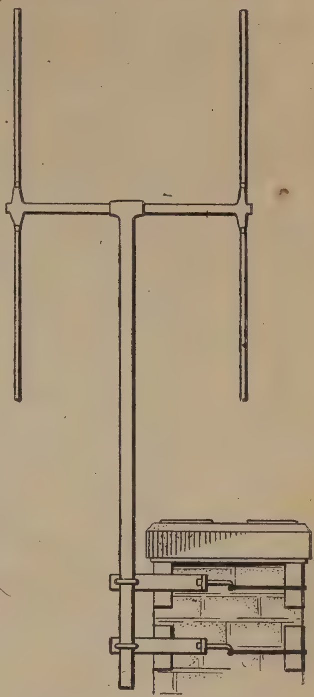
It may be thought that the fitting of outdoor television aerials is liable to cause damage to property, particularly when the aerial is attached to the chimney stack.

This is far from correct because a method of chimney mounting adopted by all reputable aerial manufacturers makes use of a right-angled bracket which is tensioned against a corner of the stack by a galvanised stranded steel lashing, which also passes over protective angle brackets located on the remaining corners of the stack. The supporting member of the aerial proper is then secured to the main bracket.

This method of attachment avoids making the aerial a landlord's fixture and can assist in strengthening chimney stacks.

The component parts of the aerial are usually fabricated from high tensile, light alloy material designed so that their erection may be carried out with the minimum amount of labour and exertion. In addition, the down lead from the aerial to the receiver may be routed inconspicuously.

The risk of outdoor aerials attracting lightning is negligible and should not be allowed to affect the type of aerial selected.



Type 7.—Standard "H" aerial.

Communal and Multi-point Systems

In strong signal areas it is possible to operate a number of receivers directly from one efficient aerial installation. Where this is done it is important that certain technical considerations are observed in connection with the wiring as otherwise reception may vary from one receiving point to another. It is also possible that the television receivers connected to the system may affect each other. By using an amplifier between the aerial and the receivers to increase the strength of the signal a large number of receiving points may similarly be supplied by one aerial. Such arrangements are usually referred to as "communal aerial systems" are ideally suited for blocks of flats or small individual dwellings situated in close proximity to one another.

The aerial for such systems can be installed in the optimum position having regard to signal, interference and appearance. A complete installation of this type can usually be installed at less cost per point than individual aerials.

Many such installations have been carried out with most successful results.

As in the case of single installations, each building or group of buildings presents an individual problem and it is necessary for tests to be carried out and an examination of the property made before a workable scheme can be put forward.

It is hoped that these notes make it clear that it is impossible either to standardise or regulate the installation of television aerials without recourse to preliminary tests of a practical nature

PRACTICAL

Popular Time-bases Explained, and Sc

By ERIC

THE experimenter who has decided to make his first tentative steps towards learning cathode ray tube technique will not go far before he meets the term "time-base."

On pursuing his inquiries further, he will find himself tangled up with Thyratron, Transitron-Miller, and Puckle time-bases, to mention only a few of the most popular types. He will also note that for oscilloscope work linearity seems to be an important factor, and yet some of the circuits that he sees incorporate special linearising circuits while others do not. He may even learn that some of these circuits give outputs that are exponential in character but can, nevertheless, be used for work where some degree of linearity is obviously a necessity.

Emerging from all this in a slightly-bemused condition, he may decide, finally, to build a complete oscilloscope from one or other of the excellent articles that have appeared in these pages, and not worry too much about how it works.

It is precisely at this stage that he can learn most

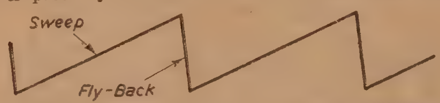


Fig. 1.—This diagram shows the ideal time-base output.

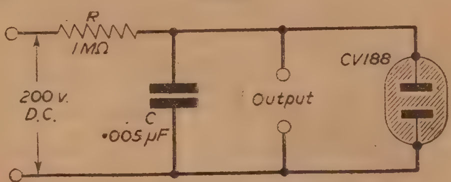


Fig. 2.—A neon time-base.

about time-bases. With an oscilloscope at his service he can investigate various experimental hook-ups and compare them in detail, one with the other. This may be done by substituting the hook-up for the existing time-base or by displaying the output from the hook-up *on* the existing time-base.

If he is fortunate enough to live inside a television area, then experimental receiver time-bases should be an interesting field for research.

The writer claims no originality for the time-base circuits given in this article. They are all of conventional design, and they are circuits that he has used successfully in oscilloscope work.

General

Basically, a time-base is simply an oscillator in which a condenser is arranged to charge up slowly and discharge rapidly, or in some cases to charge up rapidly and discharge slowly.

The resultant voltage output, taken from across the condenser and applied to the X-plates of the cathode ray tube, causes the spot to be drawn slowly across the screen then returned rapidly to the beginning of its stroke when the cycle is repeated. The words "slowly" and "rapidly" are used here in a comparative sense, that is to say, that while one part of the cycle is very slow compared with the other the whole action may take place in a minute fraction of a second. The actual time is, in fact, determined by the constants of the circuit and can be arranged to give a repetition frequency of from a few cycles per second up to 250 k/cs. or more.

The ideal output from a time-base generator is shown in Fig. 1. It is in the form of a saw-tooth in which the rise in volts is constant with respect to time; in other words, a linear rise followed by a very sharp fall which brings the voltage back to its starting point. This corresponds to the sweep of the spot across the screen followed by the sudden fly-back which returns the spot to the start of the sweep.

If the rise in volts is not linear, then the spot will not be drawn at a constant rate across the screen, and any waveform displayed on the screen will be shown distorted from its true shape. Marked non-linearity may easily be detected by displaying a number of cycles of an oscillator output on the time-base. If the departure from linearity is great, then the waveforms will appear bunched on one portion of the trace and open on another, instead of being spaced evenly along its length.

The Neon Time-base

This is the simplest of all time-bases consisting as it does of only a capacitor, resistor, neon lamp, and D.C source, as shown in Fig. 2. Nevertheless, the principle of this time-base is the same as that of the more complex valve-driven circuits.

It operates by virtue of the fact that if the voltage across a neon tube is gradually increased from a low value, a point will be reached when the lamp suddenly lights and passes a heavy current. This is called the "striking voltage." If the voltage is now reduced from this point, the tube will remain alight until at some considerably lower value the light suddenly goes out. This is the "extinguishing voltage."

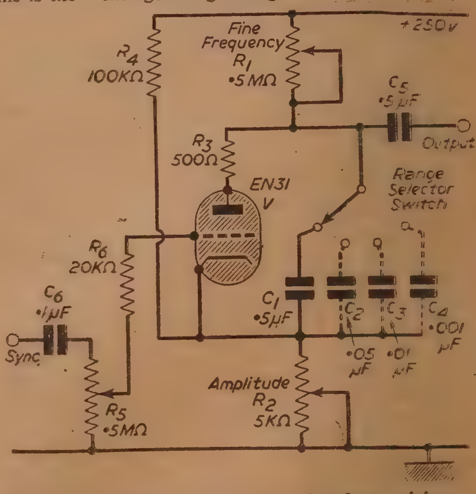


Fig. 5.—A practical thyratron time-base giving a frequency coverage of 25 c.p.s. to 25,000 c.p.s.

IME-BASES—1

e Tested Circuits for the Experimenter

OWDON

Assume to start with that condenser C is discharged. We now apply D.C. to the input terminals of the circuit and C begins to charge up through R. When the volts across C reach the striking value, the neon lights and conducts heavily, thus placing a virtual short-circuit across C. The condenser discharges rapidly through the lamp and the volts across it, therefore, also fall rapidly. When the extinguishing voltage is reached the lamp will go out and cease to conduct, thus removing the short circuit from across C which commences to charge again and the cycle is repeated.

The repetition frequency depends on all the circuit constants, but in practice is usually controlled by altering the value of R or C, both of which govern the rate of charge. The amplitude of the output volts depends on the characteristics of the neon and will be equal to the difference between the striking voltage and the extinguishing voltage. If the component values shown in Fig. 2 are used, the amplitude will be in the region of 30-40 volts and the frequency will be variable in the low audible range.

A picture of the output obtained from this circuit is shown in Fig. 3, and it will be immediately obvious to the reader that there is one very serious restriction to its utility as a time-base generator—it is anything but linear. The sweep is in fact exponential, and is due to the fact that a condenser always charges up in an exponential manner when connected to a fixed source of voltage. This is shown in Fig. 4 in which the portion of the curve between A and B is that which is obtained as output from the circuit.

Note that the bottom portion of the charging curve is fairly straight, and is in fact quite linear. It will be seen, then, that if this bottom portion of the curve could be used to provide the output, say CD instead of AB, then the output would be linear enough for many purposes. Apart from the question of linearity, however, the fact that the output amplitude is so small is a distinct disadvantage.

Let us see what can be done to improve matters.

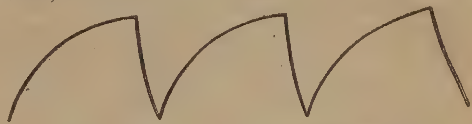


Fig. 3.—The output from a neon time-base.

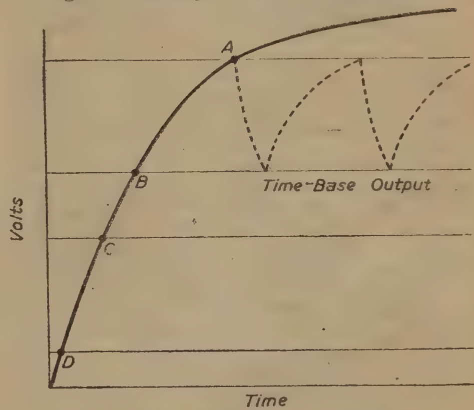


Fig. 4.—Charging curve of a condenser.

Thyratron Time-base

In Fig. 5 we have the circuit of a practical time-base which, at first sight, seems to be extremely complicated when compared with that shown in Fig. 2. In its essentials, however, it is only slightly more complicated, as we shall see.

First, a few words on the valve V. This is a gas-filled triode or thyratron, and it has certain features that are reminiscent of the neon lamp. For instance, if the anode volts are increased from a low value, a point is reached when the valve suddenly conducts heavily. This is called the "firing point." If the anode volts are decreased from this value, a point is eventually reached when the valve suddenly stops conducting.

But the thyratron has some advantages over the neon lamp. The firing point can be varied by changing the negative bias on its grid and, also, once conduction has started it remains until the anode volts have dropped to a very low value, usually in the region of 10-20 volts. The neon lamp, on the other hand, stops conducting at 100 volts in the case of the CV188, or higher in the case of other types.

This means, of course, that a much higher output can be obtained and, what is more important, we can work on the lower and more linear portion of the charging curve CD in Fig. 4.

The action of the circuit is exactly the same as for the neon time-base. The condenser charging circuit is from 250 volts positive, through R1 to C1, then through R2 to negative. Alteration of the values of either R1 or C1, or both, will alter the frequency. R2 plays very little part in the charging action, for its

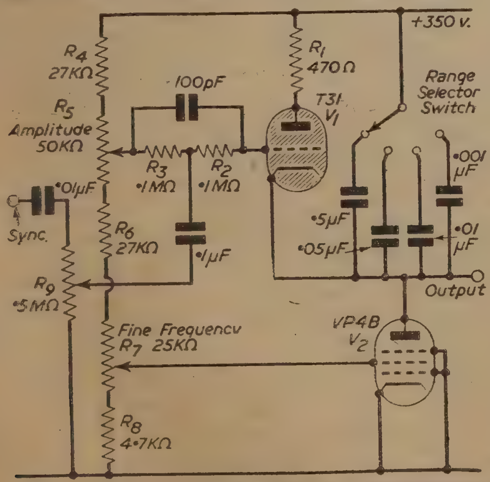


Fig. 6.—A thyratron time-base with linearising pentode.

maximum value of 5 K-ohms is so small compared with R1 that any variation here has only a slight effect on the frequency.

The discharge circuit for C1 is through the thyratron and R3 which are connected in series across it. The only purpose of R3 is to limit the current through the valve to a safe value.

Up to this point the circuit is the same as for the neon lamp. We come now to the grid and cathode connections. The cathode is tapped on to a potential divider made up of R4 and R2 connected across the H.T. supply, while the grid is taken to H.T. negative via R5. Thus the grid is negative to the cathode by an amount dependent on the setting of R2 which, therefore, determines the anode voltage at which the thyratron will fire, and, of course, the amplitude of the output voltage.

Suppose we start the operational cycle at the point where V is non-conducting and C is just commencing to charge up through R1. As the charge increases, so then does the potential at the anode which is connected to C through R3. When the anode volts reach the firing point (determined by the setting of R2), the valve suddenly conducts heavily and puts a short circuit across C which therefore discharges rapidly. As C discharges so also do the anode volts fall and continue to do so until C is nearly exhausted and the anode volts are nearly at zero. The valve suddenly becomes non-conducting again, the condenser begins to charge once more, and the cycle is repeated.

If the amplitude of the output volts so obtained is restricted to 70 to 80 volts, then the linearity will be sufficient for most purposes. Too high an output will mean that the time-base is working over the bend in the charging curve, and will thus introduce distortion.

If the picture is to remain steady on the screen of the tube it is necessary that the time-base frequency be stable, and also that it be an exact multiple of the frequency of the voltage under observation. To ensure that this relationship is maintained, a proportion of the work voltage is fed from the Y-plates of the tube to the grid of the thyratron via R5.

When the frequency of the time-base has been set by adjusting R1 and switching in the appropriate charging condenser (shown in dotted lines), R5 is slowly increased until the picture locks and remains stationary on the screen.

This arrangement, however, suffers from the disadvantage that in order to obtain a reasonable degree of linearity the output must be restricted. Further, there are some purposes for which the linearity so obtained is not sufficient. It may, therefore, be necessary to eliminate these defects by introducing a linearising device into the circuit.

Linearising the Time-base

We have already seen that the non-linearity is due to the exponential charging characteristic of the condenser. Briefly, the action of a charging condenser is as follows:

When a D.C. voltage is applied to the condenser via the charging resistor a heavy current flows initially which rapidly builds up the charge, and so the volts across the condenser also rise rapidly at first. Then the rate of charge begins to decrease. The charging current falls off, becoming progressively smaller and, therefore, the rate of rise of voltage across the condenser also falls off.

If, however, the charging resistor in series with the condenser can be replaced by a device which will not tolerate any change in the value of the current flowing through it, in other words, something that will maintain a constant current flow into the condenser, then, obviously, the rise in volts across the condenser will also be constant, that is to say, linear.

Fortunately, it is a fairly simple matter to arrange this, and a most convenient substitute for the resistor is a pentode valve in which the screen and grid electrodes are maintained at a constant D.C. potential. In this condition the pentode valve will pass a constant current irrespective of change in anode volts (within certain limits). Further, the flow of current and, therefore, the rate of charge of the condenser, can be easily regulated to any desired value by a suitable choice of grid potential.

A time-base incorporating such a device is shown in Fig. 6. In principle, this circuit is identical to that of Fig. 5, the only change being that the charging resistor has now been replaced by the pentode valve V2, which is connected for convenience in the negative side of the condenser instead of the positive. In this case, R7, which controls the potential of V2 grid, and, therefore, the value of current flowing through it, is the fine frequency control.

A point to watch in this circuit is that a separate heater winding must be used for the thyratron, and one side of the winding or the centre tap should be connected to the cathode instead of being taken to chassis. This obviates the risk of a high potential being developed between heater and cathode which might destroy the valve.

The linearity and amplitude obtained with this type of circuit is sufficient for most amateur requirements, but there still remains one defect, and that is, the circuit is of little use at high frequencies.

The writer has obtained good results up to 25 k/cs., and some experimenters have gone as high as 35 k/cs. In general, however, the ceiling is round about 25 k/cs.; above this the amplitude falls off and other deleterious effects creep in.

If high frequencies are required then we must resort to "hard" valve time-bases, and we will now deal with two popular types.

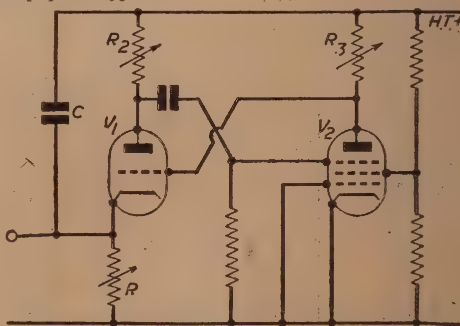


Fig. 7.—The basic circuit of the Puckle time-base.

The Puckle Time-base

This time-base was evolved many years ago by O. S. Puckle and is undoubtedly a classic of its kind. The fact that it is still used to-day—with refinements—in many modern laboratory instruments is a tribute to its efficiency. It will operate successfully up to more than 250 k/cs.

The basic circuit is shown in Fig. 7, and it is convenient to explain the action commencing from the point in the cycle when C is just beginning to charge up through the charging resistor R.

(To be continued.)

Scenery for Television—3

Constructing and Setting

By PETER BAX, Head of Television Design

THERE are other trades which contribute to the creation of scenery. After all, no room is complete until it is furnished. Someone must, after the producer and the designer have specified it, go out and find the furniture or, if he fails, someone else must make it. We have not only had to make Saxon stools and Spanish tables but sedan chairs, Venetian gondolas, spinning wheels and virginals. Some of these, although not strictly furnishings, are accessories that the property maker must be prepared to supply. Curtains, carpets, tapestries, cushions, special upholstery and "old masters," are all called for as well as a list of strange things that would stretch from London to York.

Perhaps one of the most intriguing corners of the workshops is the one where the papier mâché is made. Where a film studio uses plaster we mostly use papier mâché. The reason is lightness. Our scenery stands only for a little while—a few hours usually—and then must be whisked away to make room for something else. Papier mâché stands up to this treatment very well and, moreover, stands the wear and tear much better. It is strange, however, to see one man pick up a length of stone wall and carry it off with no apparent effort. The stone that looks so natural with its deeply incised mortar is really only a skin of paper about 1/32in. thick on a light wooden framework. It is in this corner, too, that bottles and plates are made for the sole purpose of breaking. How often have you seen a character in a play or film smash a bottle over someone else's head. It is not a genuine bottle, of course. We would make it in very thin plaster or even wax. Objects so made break realistically and do no damage. But, beware, of experimenting yourself. You might make the plastic just a little too thick !

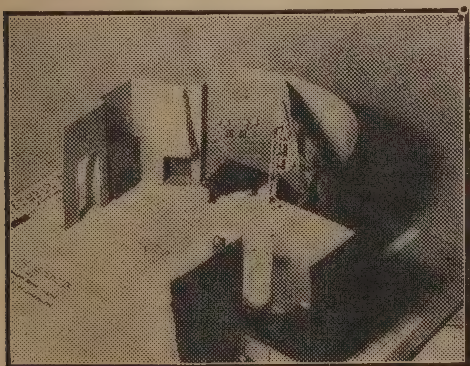


Fig. 3.—A "set" made up in cardboard to assist the producer in his layout.

Perhaps we've wandered a little from scenery proper, but it is never very easy to decide just where scenery ends and properties and furnishing begin. Even in the theatre, with all its age-old traditions, I've known the scene shifters and the property men argue this very point for hours. The truth is, of course, that a "scene," like its counterpart in real life, is not the product of any particular trade. Think, for example, of the many different sorts of people who have contributed to a simple room in your own house. It is true that scenery does not always put "the real thing" before the audience. Thus the door and the "marble" fireplace may both be made of similar wood. Even so, there is plenty of room for all sorts of skilled craftsmen in the average scene.

We use metal-work, leather-work, devices worked by electricity, steam, compressed air, water and chemicals.

Fig. 4.—Carpenters working on some steps for a setting.

At times we have to call in specialists in livestock, from horses to goldfish, gardeners, sculptors and people who will undertake to "fly" fairies safely and convincingly. All these contribute, in some way, to the scenic effects, and they must all be found, correlated and paid. Only by this means can the "Supply" side keep the "Design" side quiet and happy.

If we may now assume that the craftsmen in the workshops and all the other people have put together our scene it is time for us to follow it out of the workshops and into the studio.

The set, bright and shining in its new paint, now has to be dismantled. Piece by piece it is taken apart and loaded on to electric trucks. This loading is in itself an important process. Hours of careful work can be ruined by undue exposure to the weather or careless stacking. The trucks then carry the scenery for nearly a quarter of a mile to a large electric lift which takes it up to the studio floor. Here it is unloaded and delivered to the studio staff. Naturally great care has to be taken to ensure that the right pieces go to the right places. In a large show using two studios simultaneously there could be great confusion if this point were not carefully watched. Once in the studios the staff reassemble it

as it was before. Extra touches are added and any damage caused by handling is repaired. It is at this stage that the designer's original plan again comes into prominence, though now it has been added to considerably. The cameramen, the lighting men, the "sound" men and others can see just where they and their apparatus must go.

Naturally, a studio looks in rather a mess in the early stages of "setting." The delicate cameras are being altered from yesterday's to to-day's show. The scenic artists are probably painting the studio floor as an axminster carpet at one end and a cobblestoned street at the other—and woe betide anyone who walks on their work while wet! The "sound" men are testing microphones and the working of their "booms"—the light cranes on which the microphones are slung. In the corridor outside furniture begins to pile up while anxious assistant stage managers check it with their lists. In an hour or two, however, confusion gives place to comparative order and one recognises a room here, a flight of stairs there, and the corner of a garden yonder.

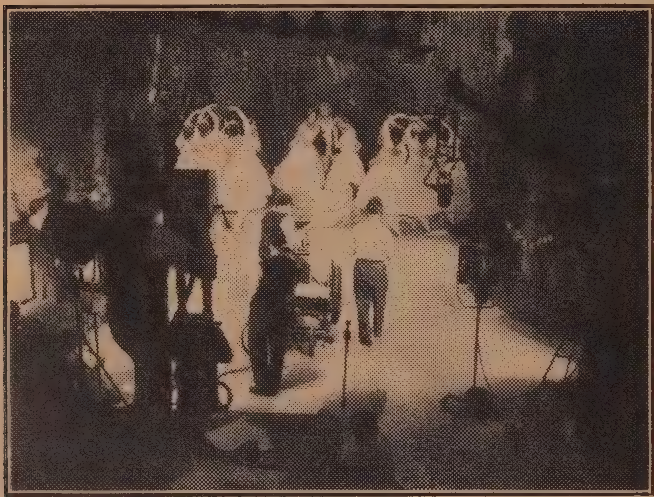


Fig. 5.—Rehearsals start on the finished set.

Glaring lights begin to flash on and off. Men shout to one another "a bit lower Bill" or "up a bit Fred," and finally "O.K."

Tension

Now one becomes conscious of a mounting tension. The producer, who will work at the fullest possible stretch for the next twelve hours, is already darting about in every corner. This is the first time he has set eyes on his scenery complete. He takes paces from the door to the window, makes sure that the door opens just as he wants it to and tests the height of the furniture. The designer is also on deck. In fact he has been there for quite a long time, but we haven't noticed him because he has been doing some last minute checking on some details behind the scenes which don't yet satisfy him. Some actors begin to arrive and are shown the stairs down which they must come, or the secret panel they must work. The cameras begin to move into position, and if you could take a bird's eye view of the studio you would see it laid out just as the producer and designer ordered it weeks before. There is a short pause while the studio crew have lunch and the actors get into their costumes. Then, in the early afternoon, the rehearsal begins. (See Fig. 5.) The designer sits beside the producer in the control gallery and is ready, if necessary, to make alterations. Perhaps the white mount of a picture is too white and draws too much attention to itself—it must be toned down. Perhaps the curtains are too thick to be seen through—thinner ones must be found.

We won't, however, go deeper into the rehearsal. That is quite another story. When it is over we'll just come down from the control gallery with a tired designer and be thankful, with him, that the scenery, the properties, the furnishings, the tricks, the "effect" and all the rest of it are now safely delivered, that the producer is satisfied. And, let us hope with him, that the viewers will be satisfied, too.

VCR97 and Shadow

A SHADOW, in most cases, is cast on the right-hand edge of a VCR97 screen. It is due to misalignment of the gun assembly, and this was done, I should say, purposely for some reason to suit the conditions of use by the Services. If the tube is used for television, it rather limits the size of mask that can be used.

I have devised a method whereby the whole of the screen can be used (I myself am using a mask built of balsa wood, carved to give an opening 4¾in. × 5¾in., with curved sides as in the latest Cossor model).

Magnetic Effect

It seemed to me that the only way to get the "spot" right over to the edge of the screen was to "pull" it over with a magnet, which I have done, simply by placing a home-made magnet (which must be on the long side) at the side of the tube neck.

An old file was used, broken, about 5in. long and very lightly magnetised by just touching it to the P.M. speaker magnet. It was then tied lightly to the tube neck and slid along and twisted until the picture was moved over equally top, middle and bottom edge, without distortion. To get this effect requires a very light magnet; if picture is pulled over too much, the opposite end of file should be touched to speaker magnet, and so adjusted till a point is reached where picture just fills the mask.

Any piece of hard steel may be used in place of the file, but it must be quite long—about 5in.; very lightly magnetised; and the "N" end uppermost. If you have a shadow on the left-hand side as well, another magnet may be used on that side also.—L.O.H.

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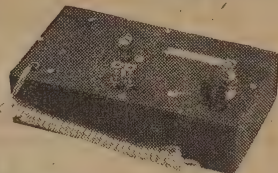

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TELEVISION PRINCIPLES AND PRACTICE

5.—Saw-tooth Waveforms

By F. J. CAMM

THE principle employed in the production of saw tooth waveforms is that of the charge and discharge of a condenser, in which the slow exponential rise of voltage across the plates is made use of to attract the light spot across the screen which is coated with a fluorescent material, sudden discharge allowing the spot to return to its initial position in readiness for the following sweep.

In the majority of cases concerning oscilloscope design only a single-line time-base is used, the spot sweeping across the screen at a speed of several thousand miles per second, and because of persistence of vision giving the illusion of a straight line without break;

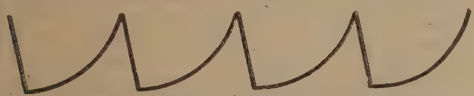


Fig. 17.—The saw-tooth waveform produced across a condenser, showing the exponential build-up.

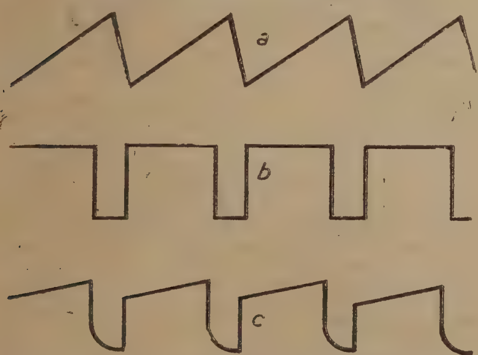


Fig. 18.—Voltage waveforms which must be applied to (a) resistance only; (b) inductance only, and (c) resistance and inductance, in order to produce a pure saw-tooth current waveform.

but in television, although the same principle applies it is necessary to introduce a system which will prevent the spot from moving along its own track with every sweep, but moves downwards by an amount equal to its own diameter. Thus, the complete area of the screen is covered by the spot and building up what appears to be a continuous area of light. Hence, it is necessary to employ two time-bases, one to move the spot horizontally and the other to move it vertically, and this is achieved in the following manner. A condenser is charged through a resistance from a source of D.C., and is abruptly discharged when a certain point is reached, this usually being achieved by means of a valve which has reached saturation point. Fig. 17 shows a saw-tooth waveform, and a feature of this is that the part representing the charge must be practically linear. During the discharge time, although the precise shape is not of particular importance, the ratio of forward to return time should be kept to the minimum.

A saw-tooth voltage wave is required with tubes which employ electrostatic deflection, in which respect it differs from electro-magnetic deflection in that the latter requires a saw-toothed current wave. The former is used for line scanning and the latter for frame scanning, although not entirely. In passing it may be mentioned that saw-tooth voltage waves are simpler to produce as will be seen later on.

Fig. 19 shows the circuit necessary to produce a simple voltage wave. The valve is biased by the battery beyond the cut-off point and it so remains until a positive pulse greater than the voltage of B is applied across the resistance. At the point where the valve is non-conducting the condenser C commences to build up a charge from the battery B1 through the resistance R1, and this continues until the positive synchronising pulse appears across R. At this point the valve conducts and discharges the condenser. The cycle of events continues.

It will be obvious that the frequency of the saw-tooth wave is dependent upon the frequency of the synchronising pulse, by which means it is controlled. Thus, in a complete circuit, this pulse is designed to be produced by a blocking oscillator or a phase reverser controlled by the condenser build-up. The rise of voltage across the condenser may be made almost linear by employing only the first part of the charge cycle or by means of a constant current device which replaces the charging resistor.

Saw-tooth generators employing hard valves in preference to the gas-filled type are used for line scanning where the frequency of the waveform needs to be high.

Now the deflection of the electron beam in a cathode-ray tube is dependent on the magnitude of the current flowing in the deflector coil, and for electro-magnetic

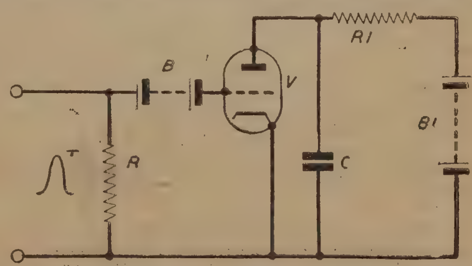


Fig. 19.—Circuit of a simple saw-tooth generator triggered by a positive sync. pulse.

scanning it is necessary to produce a saw-tooth current waveform. This would be easy but for the important fact that the deflector coil possesses inductance as well as resistance. Hence when a saw-tooth waveform is applied to them distortion occurs which destroys the saw-tooth effect; in order to obviate this the waveform must be such that when it is applied to the deflector coils the required saw tooth is produced. The waveform of voltage which must be applied may be calculated, if the inductance and resistance of a

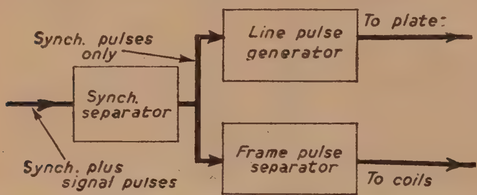


Fig. 20.—A block diagram of the sync. signal, line and frame separator systems.

particular pair of deflector coils is known, by applying the usual formula.

A saw-tooth waveform, as noted earlier, is required for coils possessing resistance (see Fig. 18a). If the coils have inductance but no resistance, it would be necessary to apply a series of square pulses of a duration isochronous to the fly-back time and the current would then be of saw tooth form, in which respect it follows the law relating to the voltage charge of a condenser (Fig. 18b). It is found, however, in practice that where resistance and inductance are both present in the coils the waveform of a and b (Fig. 18) must be combined in proportions which depend upon the magnitudes of resistance and induction. This will produce the shape shown by Fig. 18c.

A circuit which will produce a voltage wave, as shown by Fig. 18c is given in Fig. 22, which resembles to some extent Fig. 19, with the exception that the resistance R2 is in series with condenser C. The synchronising pulses across R, the build up of voltage across C and the cycle of events in their entirety is precisely the same as for Fig. 19, being employed to obviate the resistance drop of a deflector coil.

It can be demonstrated that the voltage across R2 follows the form of a pulse similar to Fig. 18b, if the resistance is much smaller than that of the resistance R1. The reason is obvious—there is a surge of current through R2 as C discharges.

We can now see how the scanning spot is caused to scan the fluorescent screen by a combination of horizontal and vertical time-base systems. To recapitulate, and commencing with the spot in the top left-hand corner of the cathode-ray tube (Fig. 21) a saw-tooth waveform is applied to the horizontal deflector plates with a frequency equal to the number of lines required per frame multiplied by the number of frames required per second, and a saw-toothed current waveform is passed through the vertical deflecting coils of a frequency equal to the number of frames required per second.

The lined area of the screen is called the *raster*, and the triggering of each time-base in synchronism with the scanning at the transmitter will be dealt with later.

Synchronisation

The image received on the end of a cathode-ray tube is the counterpart of the pulses (line and frame synchronising) produced by the scanning system at the transmitting end. When received they control the scanning devices so that the spot on the frame of the received image is in precisely the same position as the picture element being scanned at the transmitter.

Although there are many methods of generating synchronising pulses, that most frequently employed is a controlled multi-vibrator associated with the scanning system of the television camera. Whatever system is employed its purpose is to mark the end of each line and each frame. The frame pulse is of longer duration so that it is possible to distinguish between them, and the receiver separates them by this difference in duration. They are transmitted with the vision signal, and interference with a vision signal is avoided by making the pulses correspond to the polarity of black, their amplitude being greater than the greatest signal amplitude for a black section of the image.

Now when the receiver picks up the combined signal and synchronising pulses it must separate them, and this

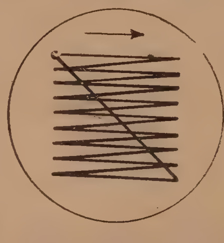


Fig. 21.—This exaggerated diagram shows a spot tracing out a rectangular area in the form of a series of lines flying back at the end to recommence the trace.

is done by taking advantage of the differences in amplitude. In other words, a valve is biased beyond cut-off to provide maximum signal current. The synchronising pulses, of greater amplitude than the signal currents, raise the bias enough to permit the valve to conduct and to pass to the anode circuit free from signal variations. The pulses are next passed to a network separating the line and frame pulses (see Fig. 20).

A small advantage is obtained by transmitting the

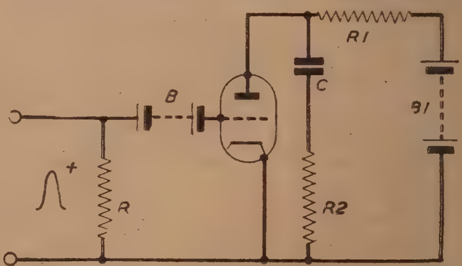


Fig. 22.—Circuit suitable for producing a voltage waveform of the shape shown in Fig. 18(c).

synchronising pulses with a polarity corresponding to black in the picture on the end of the receiving tube, because if their duration is equal to the flyback time of the spot at the end of each line and frame the spot is cut off and return lines do not appear. They would, of course, interfere with the picture.

(To be continued)

The Mechanics of Marionettes

Some Facts About These Television Props.

By JAN BUSSELL, of The Hogarth Puppets

A MARIONETTE is a puppet or jointed figure worked by strings. To make one is not nearly as difficult as many people suppose ; a large degree of success depends not on the making but on the manipulation and presentation for which considerable practice and a definite flair is necessary. Nevertheless this practice can afford a great deal of fun, so if you enjoy doing things with your hands why not try your skill as a puppeteer?

This article is written very much for the beginner, and the suggestions in it can be elaborated according to your skill. Far more important than the technicalities is the original conception of the puppet to be made. It must first be visualised in great detail : think about the personality, voice, characteristics and movements, as well as the shape of the nose—which of your friends would be fun to satirise? Even a circus clown, a variety act or a puppet for a play should be based on observation of people you have met. But whatever you decide, the puppet should as far as possible go one better than his human counterpart, for this is where its success will lie. To take examples: Punch not only excels us in his grotesque appearance, but in his extravagant doings ; Muffin the Mule and his Hogarth Puppet friends are all caricatures.

When you have seen it clearly in your mind's eye the next step is to draw the figure on a large sheet of paper, the actual size of the finished job. The height can be anything from 12 to 18 inches. Mark off where the waist will come, how long the head, arms and legs will be, and the whereabouts of the knee and elbow joints. This will be your working drawing. If you can draw in features, so much the better, but a few lines decipherable only by yourself are just as good, provided you have visualised them clearly in your mind.

The Head

The head of a marionette is generally made rather larger in proportion to the body than in the case of humans. It can be of wadding stuffed into an oval cover, with a nose, button eyes and woollen hair sewn on, or carved from wood (lime wood is probably the easiest for this) or made of plastic from a plaster of paris mould, or of papier maché. Here is a simple papier maché process.

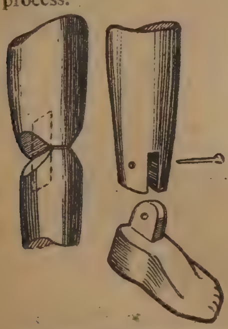


Fig. 2.—Knee and ankle joints.

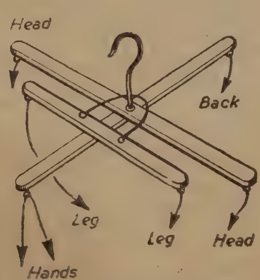


Fig. 3.—The operating 'perch.'

The head is first modelled in Plasticene. Roll it between the hands into an oval of the size required. The point of the oval will be the chin. Press out two hollows for the eyes with the thumbs. Roll two small eyeballs from some spare Plasticene and place them in position. Make nose, lips, ears and hair in the same way and stick them on. A penknife is useful as a modelling tool for adding finishing details, parting the lips, etc. It is a good plan to look at the head in a mirror from time to time, to get a fresh idea of it. Do not go in for too much detail in the modelling. The broad effect is what is required : such things as eyelids and nostrils will not show over the footlights and are best left to the expert.

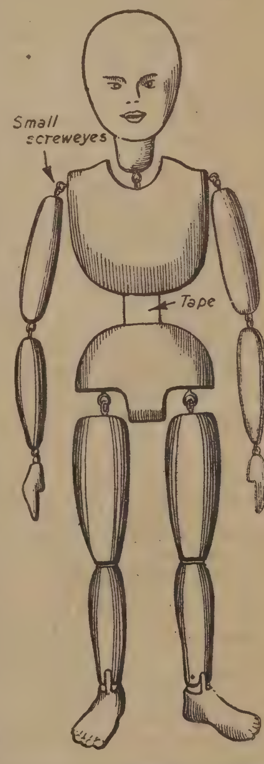


Fig. 1.—A completed puppet ready for clothing.

When you are satisfied with the head get together some coarse newspaper, a bucket of water, a bowl of cold water paste and small brush, and a nice flat surface such as a sheet of glass or a tin tray. Tear the newspaper into sheets of equal size—about quarter of a full-size page. Dip one piece into the bucket of water, shake off the surplus water and lay it out on the tray. Give it a coat of cold water paste, dip another piece in the water and lay it on top of the first. Now cover this one with paste. Place a third piece of wet paper on top again and apply the paste once more, so that you now have a three-tier sandwich of paper and paste. Tear off little pieces of this sandwich not much larger than a postage stamp and place them over the Plasticene model. Experience will show the best shapes to apply in different places. Where the modelling is elaborate the pieces of sandwich covering it should be smaller. Each piece should overlap the previous piece, so that in the end the model is completely covered. Eyes and lips can be given extra modelling in the paper itself as you go along. A match stick makes a useful tool for this. The paper must be left to get quite dry and then the whole process is repeated, so that the head has now six layers of paper everywhere. This is enough for most purposes, but a third application will make the head very strong.

When the last application is perfectly dry cut the

head in half from top to bottom behind the ears, scoop out the Plasticene, and stick the two shells together with more paper sandwich. A wooden dowel should be glued in to form a solid neck and it is advisable to put a wooden bar inside between the ears which will later be useful to take screw-eyes for the head strings.

The Body

The same technique can be used for all the other parts. However, for bodies wood is probably better, having more weight. The body is generally divided into two parts, loosely jointed at the waist by strong tape or linked screw-eyes. This gap is, of course, hidden by the costume. A wooden body can be quickly cut out with a saw and rounded with a rasp. A screw-eye is driven into a " u "-shaped recess where the base of the neck is to be joined in. A screw-hook in the neck itself is engaged with this and closed up with pliers so that it cannot come off. Arms and legs are best made from lengths of wooden dowel shaped with a chisel or a penknife. Linked screw-eyes, tape or string can be used for shoulder, elbow, wrist and thigh joints, but knee and ankle joints must be made to bend only in the one direction, and no further than is necessary. A strip of leather glued into saw cuts in the ends of the two dowels makes a good knee joint. The parts should be jammed together as closely as possible, and the wood cut away at the back of the knee afterwards to allow movement. A wooden tongue, best made of plywood, glued into the foot and pivoted on a panel pin through a groove cut in the bottom of the leg makes a satisfactory ankle joint, care being taken not to allow the toes to drop too far, or turn up. The tongues should be fixed at an angle to turn the toes out slightly. All joints must move very easily, the parts falling freely by their own weight.

Hands and Feet

Wood is suitable for hands and feet, but these can also be made by the papier maché method, leaving the Plasticene inside to give weight. Sometimes lead soles are necessary on wooden feet for added weight, if the puppet has a stiff costume. Fingers should not be separated as the strings will get caught between them and cause a lot of trouble.

Finishing

Now the puppet must be painted. This is the most exciting part of the job, and it is surprising how many weaknesses in the modelling can be concealed and how much detail can be indicated. Oil paint should be used. Flat white undercoating such as decorators use, mixed with a little Venetian red from a tube of artist's oil colour, makes a good flesh tint. A shiny finish should be avoided, as this reflects the stage lighting. The eyes and general colour scheme should be exaggerated as for stage make-up.

Use thin materials for the costume, and leave plenty of room for movement. Do not clog the limbs up with shirt sleeves and underclothes that will not show. Dressing a marionette is quite different from dressing a doll, for some of the strings will pass through the costume, and there is no question of being able to take it off quickly. Puppets that have to change their costume during a play usually have to be duplicated. So that in fixing the costume you can use glue or nails !

The Control

All the puppet's strings go to a " control " or " perch." A cross made from two pieces of wood about 8in. long held in a horizontal position makes an efficient " perch." The strings, which are of linen thread size 18, are fastened to screweyes in the wood, and a large cup hook is inserted at the point of intersection of the two bars, so that the puppet may be hung up when not in use. Fix the head strings first, making them a convenient length for manipulation. They go from the puppet's ears to the extremities of one of the bars, and should be tied off evenly so that when you rock the control the puppet will shake its head. Next fix a string from the small of the back—use a staple or screw-eye through the costume for this—to the extremity of the other bar, making it just taut when the control is in a horizontal position.

Fig. 4.—How the two sectious of the ' perch ' are manipulated to control the figures.

When you tilt the control forward the puppet will bow. Try tilting it and rocking at the same time—he will lean forward and turn his head from side to side. A string from one hand passes freely through a screw-eye on the fourth point of the cross and down to the other hand, and is adjusted so that the hands are raised to about waist level with the control horizontal. By tilting the control backwards the hands will be raised higher. Holding the control in one hand you can use your free hand to operate this string, and wave the puppet's arms independently. Leg strings may be arranged in a similar " run through " manner through a screw-eye on this same bar, rather nearer the centre : but it is more efficient to have a separate bar for the legs which is hooked by a string loop over the main cup hook and may be quickly taken off when required. The leg strings are fixed one to each end of this bar, and come from just above the puppet's knee. To make the puppet walk hold the cross-bar in one hand and move it forwards with a slight up and down movement, rocking the leg bar, to pull alternate legs, in the other. Walking is by far the most difficult feat for a puppet and requires a great deal of practice. You will find dancing to a gramophone record much easier.

Self-compensating Linear A.C. Meter

A Handy Test Instrument for Voltage and Current Readings

By G. F. CRAVEN

THE usual method of measuring A.C. by means of a moving-coil instrument is to include a full-wave bridge rectifier in the circuit. If the instrument is to be used for A.C. + D.C. measurements, certain inherent defects arise which are due to the non-linear characteristics of the rectifier over a percentage of the meter scale. With a full-scale reading of, say, 15 volts, the non-linear percentage of the reading is negligible, but for full-scale values below this value the non-linear percentage may be in excess of 50 per cent. One method of overcoming the non-linearity of the scale at low voltages is to include a potential transformer which raises the input voltage to a value which is outside the non-linear range. This method is successful where comparatively heavy currents are flowing, but for light current work the voltage drop due to the current drawn by the transformer introduces serious errors. Similarly, on A.C. current measurements it is impossible to use a rectifier-moving-coil combination across a shunt, as the meter is then operating as a low-reading voltmeter and has a very bad scale shape. Here again a transformer is used, the design of which is extremely difficult where small bulk is required with accurate results.

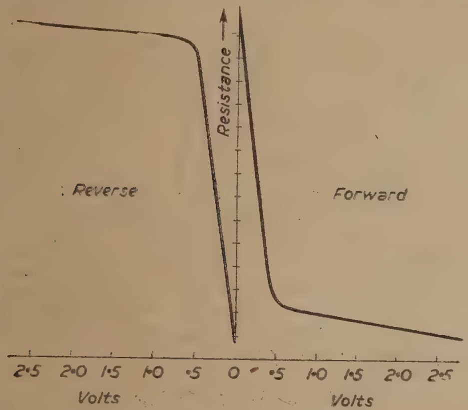


Fig. 1.—Rectifier characteristics.

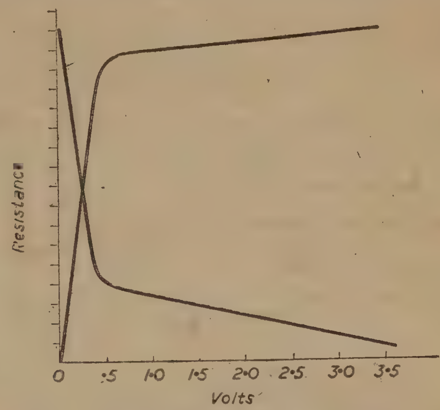


Fig. 2.—Compensated rectifier characteristics.

Defects Overcome

To overcome these difficulties and to provide a scale which is absolutely linear on any A.C. voltage or current measurements, a circuit has been evolved which is entirely suitable for inclusion in a universal meter. It has the great advantage of using the same scale for A.C. + D.C. measurements without transformers, and introduces no more error into the readings than any high-resistance meter with bad scale shapes.

Consider the characteristic curves of a copper-oxide rectifier. It will be seen that as the voltage rises, the

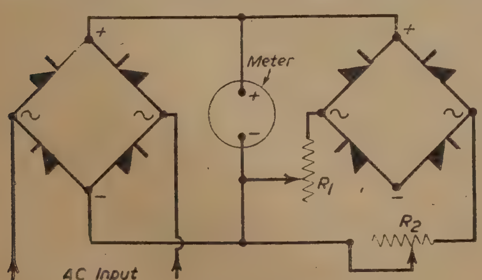


Fig. 3.—Compensated rectifier circuit.

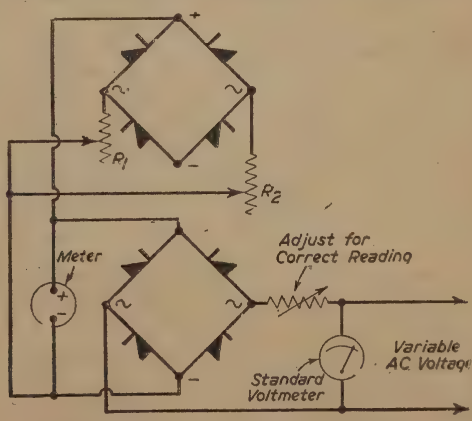


Fig. 4.—Calibration as an A.C. voltmeter.

resistance of the rectifier element falls in one direction and rises in the other according to the polarity of the voltage. It is these changes in resistance which provide the rectifying action, the impedance being very high for currents flowing in one direction and very low when flowing in the reverse direction. As will be obvious from the curves in Fig. 1, the changes in resistance are non-linear in the extreme.

Consider now Fig. 2. If one curve in which the resistance is decreasing is superimposed upon a curve where the resistance is increasing, the resultant curve will appear as a straight line and will, therefore, give a linear scale. This method of compensation is the one used in the circuit about to be described.

The instrument and its conventional rectifier are coupled in the usual manner. A second instrument rectifier, identical in characteristics to the first, i.e., current rating, manufacture, etc., is coupled in parallel to the meter. The positive side of the compensating rectifier is taken directly to the positive terminal on the meter, whilst the negative side is not connected. From each of the A.C. terminals on the compensating rectifier a connection is made to the negative side of the meter via a variable resistance (Fig. 3). The function of these resistances is to balance any slight discrepancies in the rectifier elements and may be adjusted to give perfect linearity. Once set, they need never be altered again. The values of these variable resistances should be variable from zero to approximately 10 times the meter resistance.

Setting Up and Calibrating Procedure

To calibrate the instrument as a voltmeter, the series resistance to give full-scale deflection is very nearly 90 per cent. of that required to give full-scale deflection on D.C. For accurate results, a variable resistance of value greater than is necessary is coupled in series with the circuit. A variable source of A.C. is required, together with a reliable A.C. voltmeter. The equipment is set up as in Fig. 4, and the variable series resistance adjusted to give a full-scale reading which agrees with that on the standard meter. Next, the linearity is checked by varying the A.C. supply from maximum to zero, the compensating variable resistors R_1 and R_2 being adjusted to preserve the linearity. When the meter is linear from zero to full scale, the series variable resistance is measured to give the value of resistance in series with the meter. This procedure is then carried out for all the other required ranges, with the exception of the adjustments to the resistances R_1 and R_2, which are now set for all ranges. The value of resistance in circuit, which is provided by the variable series resistor, is the value required as a fixed resistor on each range.

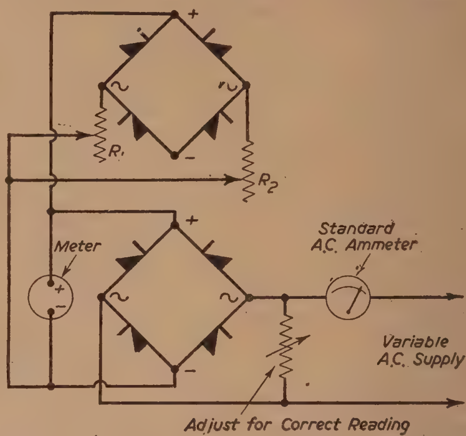


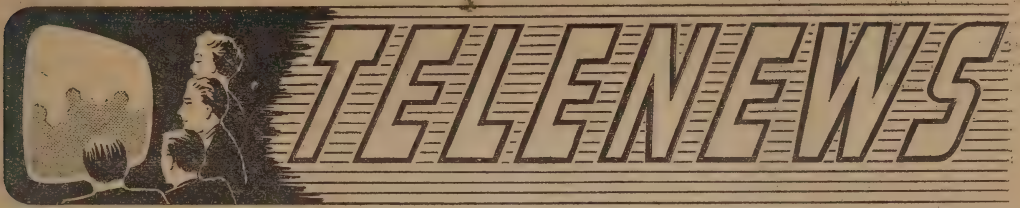
Fig. 5.—Circuit for calibration as an A.C. ammeter.

The instrument may be calibrated as an ammeter by coupling a variable resistance across the rectifier A.C. terminal and by using a standard A.C. ammeter in series with the variable A.C. supply leads (Fig. 5). A procedure similar to that of the voltmeter calibration is used, and here again it is unnecessary to adjust R_1 and R_2. The value of resistance in parallel with the circuit is that which is required to give full-scale deflection when the standard meter and the instrument being calibrated agree.

E.M.I. Film Projector

THE E.M.I. film projector incorporates an Emiscope of the high-voltage projection type having a fluorescent screen of uniform texture and short delay time, upon which a luminous raster of the standard interlaced pattern is formed by the scanning action of a sharply-defined electron beam. Two images of this raster, which is of double the normal aspect ratio, are formed in the picture gate of the projector by means of a bi-lens system. The film is carried through the gate at constant speed, and the upward progression of the luminous spot over the downward-moving film results in the complete scanning of one film frame during the television frame period. The two images of the scanning raster are mutually displaced by the distance through which the film advances during this period, so that a second scanning, interlaced with the first, follows immediately. The two images are thus made use of alternately to accomplish the complete interlaced scanning of one film frame in the picture repetition period. The transmitted light, modulated in intensity by the interposition of the film, is collected by a photo-cell unit which incorporates a high-sensitivity photo-cathode followed by eleven stages of electron multiplication. This unit delivers picture signals to an amplifier including circuits which provide for variation of picture contrast.

The equipment is housed in a group of cubicles. These are of uniform design and are fitted with front and rear doors concealing all apparatus except that to which operational access is necessary. The circuit apparatus is accommodated on a series of panels; these are mounted vertically and the layout of components is such that valve replacements and routine measurements are carried out from the front of the cubicle, whilst the adjustment of pre-set controls is effected from the rear. Provision is made for incorporating both a 16 mm. and 35 mm. projector. The projectors, each in its own cubicle, are located on either side of the cubicle containing the scanning Emiscope, and a rotatable inclined mirror is provided for the purpose of directing the light into the picture head of either. By this means the alternative use of the two projectors is made possible without duplication of any apparatus other than the optical systems and pick-up devices. Either projector may, of course, be omitted from a particular installation if it is not required and in such a case it could be added at a later date.



British Television in Sweden

A DEMONSTRATION of British television has been one of the attractions offered by the Liseberg Gardens in Gothenburg recently.

Visitors to the Gardens paid for admission to view receivers in the Rotundan and also to watch a studio in operation in the Konserthallen. The complete studio set-up including cameras, control equipment and lighting was put in by Pye, Ltd., of Cambridge, and many Gothenburgers paid visits to the Gardens to watch the varied programmes being screened.

The four weeks' demonstration closed on June 4th, and has done much to increase the prestige of British television in Sweden.

Aerial-less Television Sets at Wimbledon

PORTABLE television sets were again installed in the players' dressing-rooms at Wimbledon this year, so that contestants were able to see the progress of play whilst preparing for their own matches.

The sets installed worked entirely without an aerial, and are an all-British invention.

Radio and Television Electricity Load

SIR VINCENT DE FERRANTI, M.C., M.I.E.E., in his presidential address to the second British Electrical Power Convention at Harrogate recently, pointed out that with an electric system all sorts of unexpected and considerable loads appeared.

"As an example of this," continued Sir Vincent, "is radio and television, which have not only made a supply of electricity an absolute necessity in every home, as indicated by the rapid increase in the number of consumers connected during the boom years of that industry, but have brought a connected load of 1,200,000 kw. to the supply system."

Suppress It!

AS part of a campaign to overcome motor-car interference an unusual film has been prepared by the B.B.C., by arrangement with the radio industry, showing how easy it is to fit any car with an interference suppressor.

The film, which is now being televised at intervals, incorporates the sort of interference familiar to most viewers—the "snowstorm" effect on the picture and the "machine-gun rattle" on the sound—when an unsuppressed motor-car travels near a television-receiving aerial. After the film's opening announcement has been submitted to this form of interference, the picture steadies for a straightforward demonstration of two kinds of suppressor and how to fit them. One is a simple type, costing between 1s. 6d. and 2s., which is fitted on the car distributor head and will stop most forms of interference. With the other type, also shown in the film, the ignition cable is cut and the ends screwed into the suppressor, which cannot be shaken adrift by the vibration of the engine. The fitting of a suppressor in no way impairs the efficiency of the engine.

The film ends, as it began, with a burst of interference and a reminder from the announcer that sparks from your car spoil other people's pleasure.

Building Contract for Scottish Television Station

THE B.B.C. announces that the building contract for the Scottish television transmitting station at Kirk o'Shotts has been awarded to Messrs. M'Lean & Co., of Wishaw, Lanarkshire. The same firm has the B.B.C.'s contract for constructing the approach road and preparing the site, and work will commence on the buildings themselves immediately the road is ready.

Broadcast Receiving Licences

STATEMENT showing the approximate numbers of licences issued during the year ended May 31st, 1950.

Region	*Number*
London Postal	2,309,000
Home Counties	1,628,000
Midland	1,716,000
North Eastern	1,879,000
North Western	1,591,000
South Western	1,051,000
Welsh and Border Counties	724,000
Total England and Wales	10,898,000
Scotland	1,117,000
Northern Ireland ..	204,000
Grand Total	12,219,000

Trent Bridge Test Match

TELEVISION viewers were able to see the Third Test Match from Trent Bridge.

The tests carried out by the B.B.C. on this link of 150 miles to Alexandra Palace have been successful, and this is the third use of the microwave link, the previous ones having been the Boat Race and the recent programme from Southend. The point between the Trent Bridge ground and Sutton Coldfield was on Bardon Hill, in Leicestershire, which is within visual range of both Nottingham and Sutton Coldfield.

This, indeed, is the most northerly point from which a television Outside Broadcast unit has operated to date. There was one mobile unit at the ground, with one camera on the pavilion, behind the sound-commentators' position, and two others on the ladies' balcony, all three cameras having telephoto lenses.

Aerial Damage

THE Rural Council at Welwyn (Herts) has insured a number of its houses against damage arising from breakage or collapse of television masts and fittings. Several Councils are considering similar action.

Paris Talks Fail

THE talks which have been going on with regard to the relaying of television programmes both ways across the English Channel have broken down. It is stated that it is mainly on technical grounds that the proposed relays cannot be undertaken for the present, although difficulties may be encountered in the matter of copyright, trade union and similar matters.

Elusive Fault

AT the time of going to press the B.B.C. are unable to state the cause of the trouble which has been experienced by London viewers. The defect is causing the picture to flicker and at times to go out of focus, but in spite of exhaustive tests and replacements nothing can be found faulty. Some small item no doubt has a defect which does not show under normal testing methods.

Welsh TV

THE Welsh transmitter is to be situated at St. Nicholas, outside Cardiff, and the latest date which has been given for completion is Christmas, 1951. This is stated to be months ahead of schedule. The site will be on the Cardiff-Cowbridge road and covers nearly 100 acres. The exact area which will be covered by the transmitter is not certain, but in view of the surprises arising out of the Sutton Coldfield transmitter it is possible that many viewers will have the choice of two or even three stations.

Saved by Aerial

DR. MICHAEL BEASLEY, of Cudworth, Yorks, is probably glad he had not installed a television aerial. Recently he was trapped in his bedroom by fire and swung to safety on his normal copper wire aerial hanging from the window.

New Plays for Television

FOR its Drama Festival, which television is planning in connection with the Festival of Britain next year, three famous playwrights, James Bridie, J. B. Priestley and Terence Rattigan have each promised to contribute an original script, specially written for the medium of television.

In addition, Val Gielgud, Head of Drama, invited early this year a number of well-known authors to write plays specially for television. Among those who have accepted are Clemence Dane, Mabel Constanduros, B. A. Young, Robert and Margaret Gore Brown, John Keir Cross, Tyrone Guthrie, L. du Garde Peach, Francis Durbridge, Lionel Brown, Denis Constanduros, Monckton Hoffe, Philip Wade, Norman Edwards, Emery Bonnett and Cedric Wallis.

This illustration shows the elaborate scaffolding used by the B.B.C. for televising the cricket from Ilford.

CLUB Reports

THE BRITISH TELEVISION VIEWERS' SOCIETY

Hon. Sec.: Leslie G. Pace, 140, Fairlands Avenue, Thornton Heath, Surrey.

THE British Television Viewers' Society held its final meeting of the season on Monday, June 19th, at Kennard's Restaurant, Croydon, when the popular band leader, Nat Allen, accompanied by attractive vocalist, Carole Carr, addressed members. Mr. Allen dealt fully with the many problems confronting the band leader in preparing and rehearsing for a television show, and referred to the infinite patience shown by producers and others at Alexandra Palace.

The speaker gave a fascinating description of the events leading to his taking up the profession of band leader; this was in reply to one of the many questions put to him during the evening. Miss Carr also spoke on her appearances in television and other programmes.

The chairman, Mr. G. H. Warren, announced at the conclusion of the meeting that the society had recently formed a Technical Branch designed to cover all aspects of television transmitting and receiving by means of lectures, demonstrations and discussions. Full details would be available in due course.

NORTHAMPTON AREA TELEVIEWERS SOCIETY

Hon. Sec.: G. T. Wilson, 95, Ennerdale Road, Spinney Hill, Northampton.

BEING a newly formed society with a membership of approximately 60, it is desired to get in touch with other societies to exchange views, etc.

Recent activities of this society include demonstrations at headquarters with several types of aerials, rejectors, pre-amp., etc. Future monthly meetings include a visit to the short-wave transmitter at Daventry and television station at Sutton Coldfield.

This society has also had a question asked in the House of Commons on electrical interference and, also, local interference caused by the Daventry transmitter in this area.

SOUTH COAST TELEVIEWERS ASSOCIATION

Hon. Sec.: R. Sawyer, 74, Berriedale Drive, Sompting, Worthing.

THE S.C.T.A. has a present membership of over one thousand viewers formed in branches at Worthing, Lancing, Brighton and Hove, Eastbourne and outlying villages. It has affiliated viewers' clubs, and the movement is expanding so rapidly since its formation in 1949 that organisation on a national scale is now contemplated.

The association's main aim is to raise the standard of television reception in areas where such reception is unreasonably and unnecessarily poor, and to press for a television station which will adequately serve London and the south coast of England.

Other functions include the tracing and suppression of local interference to television reception and a certain amount of social activity.

Membership is open to any person who owns a television set. The subscription is 5s. annually.

SUPREME RADIO, 746B, Romford Road, Manor Park, E.12 (Tel.: ILF 1260).—P.M. Focus Units for Mullard tubes, **15/-** ea.; for Triodes, **16/-** ea.; V.C.R.97 Tubes for television, **35/-**; Black Masks for same, **3/6** ea.; latest type Magnifier for above, **25/-** ea.; EF50 Valves, new, boxed, **7/6** ea.; EF50 Valve Holders, Ceramic, **6d.** ea., **5/6** doz.; Retaining Rings for same, **9d.** ea., **8/-** doz., screw type; EA50 Valves and D.I., new, **3/-** ea.; Valve Holders, bakelite type, for same, **6d.** ea.; Co-Ax Cable, 80 ohms, **8d.** yd., as above, but 50 ohms **6d.** per yd., **5/6** doz. yds.; Aerial Plug and Socket for same, **1/-**; Twin-balanced Feeder, **5d.** yd., **4/6** doz. yds.; screened as above, **1/-** yd., **11/-** doz. yds.; Fly-back type Line Trans., 5.5 k/v. output, **22/6**; 2.5 k/v E.H.T. with 4v. 1.5 amp., and 4v 2 amp C.T., **27/6** ea.; Tapped Primary .0.1 MFD, 2.5 k/v Insulated Case Cond., **3/6** ea.; 8m.m. Aladdin Coil Formers with cores, **8d.** ea.; 6m.m. with cores, **6d.** ea.; Wound Coils for London E.E. Televisor, **1/6** ea., Choke **1/-**. All parts in stock for Home Constructor Televisors. Comprehensive range of ¼ watt and ½ watt Resistors always in stock, **3d.** ea.; Mica Cond., 40PF, 50, 60, 65, 305, 307, 500, 530, 570, 700, 1,800 and 4,550 PF, all at **2/-** doz., or ass. High Voltage Rectifier Valves, VU111, **3/-** ea. Terms: C.W.O.; no C.O.D. Send 6d. extra for postage orders under £5. 2½d. S.A.E. all enquiries and lists.

TELEVISION AERIAL COMPONENTS. Alloy Tube, drawn in AW.10.C.; Mast-head Brackets alloy and wood masts, Chimney Brackets, Corner Plates and Lashing Cable, J. Strainer Bolts, U Bolts, etc. WALTER CRANE, Electrical Engineers, Wakefield. (Telephone: 2172.)

TELEVISION, RADIO, AMPLIFIERS. Repairs, modifications; special equipment built to order; home-built receivers aligned and tested; large stocks of high-quality Components, Valves, etc. Transformers to specification. Chassis drilled and punched. BERNARDS, Radio Engineers, 12, Chelverton Road, Putney, London, S.W.15. (PUTney 7538.)

VIEWMASTER Home-Televisor Constructional Drawings, 5/- post free. Send for our lists of better-performance television and radio coils and components, also free circuits. OSMOR RADIO PRODUCTS, LTD. (Dept. P.T.C.), Borough Hill, Croydon, Surrey. (CRO 1220.)

LONDON VIEWMASTER parts for sale. Details, CHATLAND, 30, Patshull Rd., Kentish Town, N.W.5.

"VIEW - MASTER"? "Electronic Engineering"? Then JAMES H. MARTIN & CO., of course, we are specialists in TV, 58, Capworth St., London, E.10. Stamp for list.

HORIZONTAL TV Slot Aerials. Tested designs. Various types. Full drawings, 5/6. STANWELLY, Kingsdown, Sevenoaks.

T.V. AERIALS.—Midland H type with 12ft. mast, **£3/10/-**; ditto, 8ft., **£2/17/6**; 3-element type, **£4/15/-**; double H or 5-element, **£6/6/-**. All complete with brackets, lashings, bolts, etc. C.W.O. Carriage paid. R.R.S., 395, Badsley Moor Lane, Rotherham.

VIEWMASTER and EE Televisors. All parts in stock. Model on show. HG RADIO, 1350, Stratford Rd., Birmingham, 28. (SPR 2369.)

RECENTLY BUILT Premier London T.V., excellent results; **£25.** Box No. 101, c/o PRACTICAL TELEVISION.

RATES

3/- per line or part thereof, average five words to line, minimum 2 lines. Box No. 6d. extra. Advertisements must be prepaid and addressed to Advertisement Manager, "Practical Television," Tower House, Southampton St., Strand, London, W.C.2.

BEL for all tele. coils. Trade supplied. Marlborough Yard, London, Archway, N.19.

PRACTICAL WIRELESS Televisor, Aladdin Former, **10d.**; Tag Ring, **2½d.**; Set of Coils, London or Birmingham, **16/6**; P.M. Focus Rings from **21/-**; Mains Transformer, 350-0-350v 250 ma, 5v 2a, 6.3v 4a, 6.3v 4a, **68/6**; Frame Osc. Trans., **9/-**. R. F. SHILTON, 19, Clarendon Rd., Salisbury, Wilts.

A PORTABLE TELEVISOR, 14 valves (all cut-price types) on a 12in. x 3½in. x 2½in. chassis—that gives some idea of the design work in our remarkable Portable Televisor. How is it done? The complete details are given in our 56 pp. fully illustrated book, at only **3/2** post paid. The set may be used for either TV area and may contain either a 3in. or 6in. tube. Why not try "Personal Portables" too, at **2/8** post paid; judging by many congratulatory letters you won't regret it. BRADBOOKS, Sennen, Penzance, Cornwall.

LONDON VIEWMASTER. Cabinet, Tube, Valves, all new; requires aligning; **£39.** 137, Widdenham Rd., Holloway, N.7.

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HAMTUNE Communication Receivers. Model CC150, the outstanding design in modern communication receivers, especially designed for the use of amateurs. Low-noise pre-selection, double frequency-changing, two 1.6 mcs. and one 115 kcs. I.F. stages, separate oscillator with stabilised supplies. "S" meter, variable selectivity, noise limiters. This is the set you have been waiting for—and at a medium price. Write for technical bulletin on this and other communication receiver designs to HAMTUNE RECEIVERS, 10, Elm St., Wellingborough.

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TELEVISION Pre-amplifiers, Single or double stage low-noise pre-amplifiers. Made to suit any type of receiver input. Special types can be made to order. Write for techical details and prices. HAMTUNE RECEIVERS, 10, Elm St., Wellingborough.

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VALVES (guaranteed new/boxed): 6V6, 6K7, 6K8, 6Q7, 6N7, 6J7, 6X5, EBC33, EF39, 6F6, 6AC7, 9D2, 5Z4, 5U4, 807, VU111, all at **6/3** each; 5Y3, VU39, 80, 6L6, at **7/6** each; 1T4, 1S4, 1S5, 1R5, at **7/3** each; all post free. Condensers, fresh stock, .1, 350v, **6/-** doz.; 500v **1/-** each; 8 mfd 500v **2/3**; 16 mfd **3/6**; 8 x 8 450v **2/9.** Mag. Lens for 6in. tube, **22/6.** Mains Trans., 270-270, 6v, 5v, tapped at 4v, **14/6**; 350-350 ditto, **15/6.** Lightweight Speakers, 5in. **10/-**, 6in. **11/6**, 8in. **12/6**, 10in. **14/6.** Special Offer: Twin Meter Panel, with M/c 0-5m/a and 0-4v meters, plus switches, controls, etc., **12/6** post free. New list now available. 1d. stamp. RADIO UNLIMITED, Elm Road, Walthamstow, E.17. (Phone: KEY 4813.)

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COMPLETE set Radio parts for 5-valve mains radio—new chassis, P.M. speaker, trans., valves, instruction, **£3.** SHACKLE, High St., Harlington, Hayes, Middx.

WANTED: First copy, "Practical Television." CRISP, 56, Lees St., Birmingham, 18.

(*Continued on page* 236)

Pre-Amplifier de Luxe. Consisting of power pack and two R.F.s. Built up and enclosed in case. **£6-19-6,** carr. paid.
Pre-Amplifier Transformer. Prim. 200/250 v. Sec. 230 v. at 30 mA. 6.3 v. at 1.5/2 amps., **19/6.**
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(Continued from page 235)

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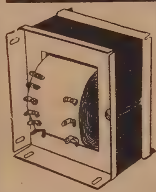

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.1 mfd. 500 v. Metal cased condensers, **8d.** each. Polystrene T/V Coil Formers and Slug, **1/-** each. Silk-covered P.V.C. Sleeve 10 K.V. Test Yard Lengths, **4d.** each. Co-axial Cable (Brand new not Ex-Govt.), 5 mm, 80 ohm. **10d.** yard. Hundreds of Component Bargains.
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£11 11s. 0d. Complete
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"Viewmaster" Televisor; Instructions, **5/-.** Components supplied separately, or in kits as follows: Whiteley, **125/-.** T.C.C. London, **135/-.** Midland, **140/-.** Westinghouse, **62/6.** Morganite (incl. V./C's) London, **35/9.** Midlands, **35/-.** Plessey, **112/6.** Colvern, **19/3.** Wearite Coils, London, **22/-.** Winrad Coils, London, **18/6.** Midland, **19/6.** "Electronic" Televisor: London Handbook, **2/6.** Wiring diagram, **2/6.** Midland Handbook and Wiring Diagram, **4/6.** Chassis, with valveholders, coil formers, etc., mounted: Vision, **22/6.** Sound, **22/6.** T/Base, **17/6.** P/Unit, **25/-.** Gantries, etc., **9/-.** Designer-approved components. (Please specify London or Midland.) Coils and Chokes. London, **15/-.** Midland, **17/6.** Focus, **30/-.** Scanning, **25/6.** L/O Transformer, **25/6.** Mains Transformer, **90/-.** 4kV Transformer, **67/6.** 5 kV Transformer, **72/6.** 5H Choke, **18/6.** 10H Choke, **13/-.**
C.R. Tubes (sent in wooden crates) 9in., **226/9.** 12in., **302/5.** Please specify make, with one alternative if possible. Sundry Items: Aladdin formers with core **5d.** each, miniature ditto, **7d.** each. P.M. Focus Rings, Mullard 9in./12in., **21/-.** Mazda/Brimar 12in., **25/-.** Other 9in./12in., **22/6.** Cream rubber masks, 9in., **11/-,** 12in., **21/6.** Coax 75Ω ¼in., **8d.** yd., ½in., **9d.** yd. Hundreds of other items, valves, etc., etc.
ALLEN & GOULD
5, Obelisk Parade, Lewisham, S.E.13. Phone: LEE Green 4038

Correspondence

The Editor does not necessarily agree with the opinions expressed by his correspondents. All letters must be accompanied by the name and address of the sender (not necessarily for publication).

COLOUR TV

SIR,—Referring to Mr. G. Keating's article (July, 1950) on colour television. As I visualise it, it certainly wouldn't give a true colour representation. The gating system described—the comparison of different lengths of frame synch. pulses—necessitates the red tube scanning for 1/50 sec. followed by the green/blue tube for the next 1/50 sec. This would mean that a white card would be transmitted as 202½ lines of red and 202½ lines of green, not superimposed, but interlaced !

Supposing the system could be modified to scan complete frames in alternate colours we now would have a picture in which red and green were superimposed but at the rate of 12½ red and 12½ green frames per second. This, surely, would have a most objectionable flicker.

No, I think the answer to true colour will be found with a system using colour sampling of a much higher frequency—several megacycles per second. Such a system is used by R.C.A. and an idea of its ingenuity can be obtained by reading a description of it.—N. ELLWOOD (Swindon).

FOCUS CONTROL IN VCR97

SIR,—The unsatisfactory operation of the focus control experienced by Mr. E. V. Ward is due to astigmatism and is common to most electrostatic tubes if, as I imagine, two of the deflector plates are tied to the 3rd anode. The trouble can be completely cured by connecting each deflector plate to a separate potentiometer.

The pots. can be adjusted by working either on the spot alone or preferably on the stationary test signal sent out every morning (excluding Sundays). First, set the pots. to mid travel so as to place the picture correctly and then, working on the pair of plates nearest the anode, increase the setting of one pot., restore the picture to its original position by adjusting the second pot., and then refocus. Continue in small steps until the best focus is obtained and then repeat for the other pair of plates. When properly adjusted both horizontal and vertical lines should focus simultaneously. If setting up is carried out on the spot alone it should deteriorate into a large, blurred spot when defocused, with no trace of elongation, either vertical or horizontal.

As regards the frame time base, there is no reason why this should not be linear without the use of a correcting amplifier. The most likely fault is the use of a leaky Miller capacitor between anode and grid. A bad coupling capacitor to the deflector plate will produce a similar fault.—L. F. PLUMRIDGE (S.E.22).

THE CRITICS

SIR,—It seems to have become fashionable recently for some critics to attempt to bring the standard of all entertainment performances, television, films, the theatre, radio and even books, down to what can kindly be described as a more "popular" level, and which some people call "the lowest common denominator in the abomination of desolation." Examples of this are easy to find; the shameful treatment of Kafka's "The Trial"; the yelps of approval whenever anything resembling an American musical appears on the horizon.

I am worried to find evidence of this trend in "Underneath the Dipole." In the May issue "Iconos" takes hold of a play by T. S. Eliot and worries it to death. The acting may not have been good; the subject ill-chosen, but I do not believe that any critic has the right to condemn a play on the grounds that it does not suit the least minority, or the greater majority, of its possible audience. Presumably, since that audience had the energy to turn the television set on, it could find the means, somewhere, to turn it off again. If the TV Executive have to presuppose a wave of chronic paralysis shortly after their evening programmes have begun, then the best advice that can be offered is that they show hints on how to eat in an iron lung.

The choice of plays at Alexandra Palace seems to be the current whipping-boy for all those critics who can find nothing more interesting to write about, or who, alternately, have forgotten how to perform their original function as critics. Although I in no way concede the point I made in my first paragraph, I would be foolish to claim that a highbrow cannot enjoy a comedy, or that a self-confesssed lowbrow is incapable of seeing some good in a tragedy. But I do defend the choice of any play, be it Shaw, Shakespeare or Sylvaine, if the man who made the choice can honestly say that he chose it primarily as entertainment, but, almost as important, also in order to pass a little more understanding on to those who see it. Pepys was not the first to remark that he found his greatest experience, and derived most understanding, not from an enjoyable occasion, but from one in which he suffered great agony of mind and body.

The function of a critic is to examine a play with exact reference to its medium and its genre. Perhaps the reason why we have so many ecstatic commendations of comedies, and so few kind words for tragedies, is because our present-day critics, except in rare instances, are more capable of understanding the simple cut and thrust, cut and thrust again, of epigram, than the deeper workings of a man's mind which we find in tragedy; but that is no excuse for the critic to attempt to dictate a never-ending choice of comedy, so that he might more easily understand what he sees and hears.—PETER G. K. WARD (Sheffield).

PRE-AMPLIFIERS

SIR,—We have read with interest the notes on Pre-Amplifiers given by Mr. D. W. Thomasson.

The information he gives should prove most helpful to those of your readers employing receivers at long distances from the transmitters, particularly as he so clearly states the case for low noise characteristics and shows the undesirability of designing for an unusable high gain. The circuit he gives is undoubtedly a most satisfactory one for long distance television reception, but as given is not the best arrangement for a pair of valves in cascade. Incidentally the term employed for this circuit is, we believe, "Cascode." For optimum results the first triode valve should be neutralized. Also, it is advantageous to parallel feed the cathode of the second triode, for thereby several advantages are secured. For example, the grid of the second triode may then be directly earthed and the overall H.T. required is lower. It is also possible to tune the cathode circuit of the second triode, thereby ensuring that correct operating conditions are obtained.

There is one difficulty, however, and perhaps Mr. Thomasson had this in mind so far as his circuit is concerned. It is not an easy matter to carry out the necessary neutralizing adjustment and the performance obtainable will depend largely on ensuring that this is correctly effected.—S. WEST (Great Yarmouth).

TELEVISION PICK-UPS AND REFLECTIONS

UNDERNEATH THE DIPOLE

By Iconos

THE lengthening days of summer had the effect of broadening the field of television. The Outside Television Broadcast Department spread itself far afield, covering an ever-widening range of subjects from horse-racing to seaside scenes, from test and county cricket to the Royal Horse Show, Richmond, or to the centre court at Wimbledon.

FULL VALUE

CERTAINLY the viewer has had full value for money in outside events alone. And if he has been unable to view the big event during the day, it is often obligingly repeated in the the Television Newsreel in the evening. This impressive "tele-cyclorama" of the current events has reached a standard far beyond the wildest dreams of the "veteran viewers"—those who viewed before the war, when there were about 10,000 television licences. The technical quality of these outside transmissions never ceases to amaze me and invariably seems to be of better definition than the studio scenes preceding them. The amount of detail seen in some of the exterior scenes on extreme long shots is truly amazing. And, I must add, it is also amazing to Americans newly arrived in England.

AMERICAN TV DEFINITION

THE television craze in America is terrific, of course, and the mass production of sets with larger and larger cathode-ray tubes proceeds apace. Tubes with flat ends, with metal sides, with integral "filters," and with still larger pictures are marketed at reasonable prices in the frenzied competition between American radio manufacturers. The big demand is for larger and larger pictures and—according to my latest information—the quality of the picture has not been improved in the fierce battle of prices. As a matter of fact, my informant stressed the very great difference between the quality of the picture as transmitted from the best American stations and the quality of the same picture as received on the average set. Tuning to different stations, sometimes with multiple aerial arrays, the terminal conditions are rarely adequate, and the combined performance of aerial and set is of a lower order than on an equivalent receiver in England. The power of most of the American transmitters is very low—many of them deliver only 5 Kw. to their aerials—and this means that a very large proportion of viewers are on the "fringe" of one or other of the local television transmitters. Compared with the leading stations in New York and Chicago, many of the small outlying stations transmit very poor pictures, having to rely on film, with tele-cine equipment which is incapable of dealing with big changes of density and contrast. My American friend sighed and reminded me of the fundamental difficulty of transmitting film photographed at 24 frames a second on a system which has a time-base closely related to the standard American 60-cycle electric supply. "Your 50-cycle supply makes things so much easier," he murmured gloomily.

52 CYCLES

AS a matter of fact, the problem of film transmission is not entirely straightforward, even on a 50-cycle supply. The film picture, usually photographed at 24 frames a second, is projected at 25, thus raising the pitch of the sound very slightly (less than a semi-tone) and speeding up the action. In the case of the B.B.C.'s own films and the newsreel, the speed of the picture cameras has now been raised to 25 frames per second, and this fault is eliminated. Most of the film equipment used by the B.B.C. was designed for the standard 24-frame speed, and in order to avoid the complicated business of changing the gear ratios of picture and sound cameras the B.B.C decided to use normal equipment and supply it with 52 cycles A.C. Apparatus for changing the frequency comprises a metal rectifier for converting mains A.C. into D.C., and the D.C. is fed to a motor alternator set, automatically controlled to give a 52-cycle output.

THE MECHAU PROJECTOR

THE B.B.C. film transmissions continue to improve, and rarely does one see shading or any of the other imperfections which marred the transmissions before the new film equipment was installed. In the meantime, the original Mechau tele-cine projectors, non-intermittent instruments of completely unorthodox design, have been transferred to other work. They are in experimental use for the recording of television transmissions—known in America as "kinescope recordings." On the Mechau projector, the picture film moves steadily past an illuminated optical system, and at the same time a drum of mirrors rotates and tilts to compensate for the movement of the film, throwing a steady image into the lens. Now, the apparatus has again been altered, with a motion-picture camera in the position formerly taken up by the lamp and with an 8in. cathode-ray tube monitor in front of the lens. The big advantage of using the Mechau projector for this purpose, compared with a normal 24-frame-per-second intermittent projector, is that the picture is scanned for a much longer period, enabling all the lines in the interlaced picture to be photographed properly. Hitherto, the value of interlacing was completely lost, since only twenty-five of the fifty interlaced frames were photographed each second.

OPEN-AIR TRANSMISSIONS

THE open air and the sunshine have reduced the number of viewers. But those viewers who were able to see the fine transmission from the Royal Horse Show at Richmond had a real treat. Here was splendid material for both picture and sound, and producer and technicians made the most of their opportunities. The positions for the cameras were well selected and it would be safe to say that every viewer could see the progress of the horses over the jumps far better than any of the actual spectators at Richmond.

The principal TV camera, evidently fitted with a long-focus lens, followed the progress of each horse over several jumps, with horse and rider almost in close-up.

TRADE TOPICS

Viewing Chair

THE accompanying illustration shows the Goodwood easy chair for viewing television. This new achievement is designed to make television-viewing more comfortable. Specially catering for the children or the grown-up viewer who likes a low seat, each article includes two extra seats giving more seating accommodation in much less space. A settee on similar lines is also available.

The new "Goodwood" easy chair for viewing.

These articles are non-utility, patent sprung throughout, all hair-filled, and covered in various textiles.

**Goodwood Upholstery and Furniture,
24, Ronald Street,
Radford, Nottingham.**

Plessey Iron Dust Core Brochure

ALTHOUGH their general application to the radio industry is comparatively recent, crude forms of iron dust cores were being made as long ago as the end of last century. The Plessey Company, who have devoted considerable research to this subject, describe in a 20-page brochure, available to manufacturers and containing much valuable information for designers, the wide range of iron dust cores manufactured in their specialised plant.

In its own metallurgical department, the company manufactures from raw material several of the varieties of iron powder used, and is thus able to exercise extensive control of both technical and mechanical characteristics. For all normal purposes, engineers will doubtless be able to select appropriate materials and types of construction from the information given in the brochure, but the company express their willingness to advise on suitable materials for specialised applications.

**Plessey Co., Ltd.,
Ilford, Essex.**

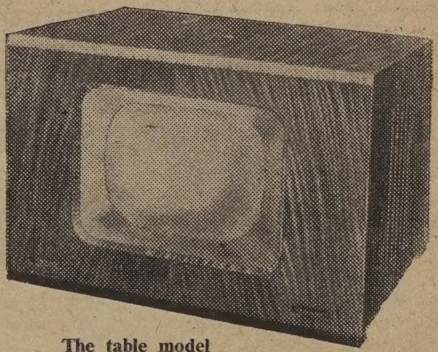
Black Screen Television

BY the introduction of the Pye "L.V. 30" black screen set and pricing the table model at only £33 8s. 10d. or 39 gns. including tax, the makers take a major step forward in their campaign to bring television into every home.

Mounted in front of the cathode tube is a plastic filter which reduces the light reflected by the tube itself, thus increasing the contrast of the picture image on the screen, cutting out flicker and eyestrain and enabling the set to be used comfortably in full daylight or artificial light. The term "black screen" arises not from the dark colour of the filter (which adds considerably to the appearance of the set when not in use, eliminating the usual "blank eye" effect) but from the fact that the dark areas of the picture are rendered really black.

The Console model costs £38 11s. 8d., plus purchase tax.

**Pye, Ltd.,
Cambridge.**



**The table model
Pye receiver with "black screen."**

Radar Tube. Type MF31-22

A NEW tube is announced by Mullard, and is Type MF31-22—a radar tube with 12in. diameter metal-backed magnesium fluoride screen.

Heater.—Indirectly heated. This tube is suitable for series or parallel operation. V_h 6.3 V; I_h 0.3 A.

Important Note.—(Applies to series operation only.) The surge heater voltage must not exceed 8.5 V R.M.S. when the supply is switched on. When used in a series heater chain a current-limiting device must be included in the circuit to ensure that this voltage is not exceeded.

Capacitances.—c_g—all 10 $\mu\mu F$; c_k—all 10 $\mu\mu F$.

Screen.—Metal-backed. Fluorescent colour—orange. Persistence—long.

Focusing.—Magnetic.

Deflection.—Double magnetic. With the effective centre of the deflector coils 292 mm. from the screen centre, the deflection sensitivity at Va2=9KV is 0.1 x L mm/gauss.

Where L is the length in mm. of the electron path through the field of the deflector coils.

Mounting.—Any, except vertical with screen uppermost.

Typical Operating Conditions.—V_{a2} 9 KV; V_{a1}, 200 V; $*V_g$ for cut-off –40 V; focusing ampere-turns 600 approximately.

* In no circumstances must the grid be allowed to become positive with respect to the cathode.

Limiting Values (Design centre ratings).—V_{a2} max. 11 KV; V_{a2} min., 4.5 KV; V_{a1} max., 400 V; $-V_g$ 100 V; $*V_{h-k}$ max., 150 V; R_{g-k} max., 0.5 Mohms; R_{h-k} max., 20 Kohms.

* The heater must be negative with respect to the cathode. It is also necessary to ensure that this value is not exceeded during the heating-up period immediately after switching on the receiver.

Base.—B12A (Duodecal).

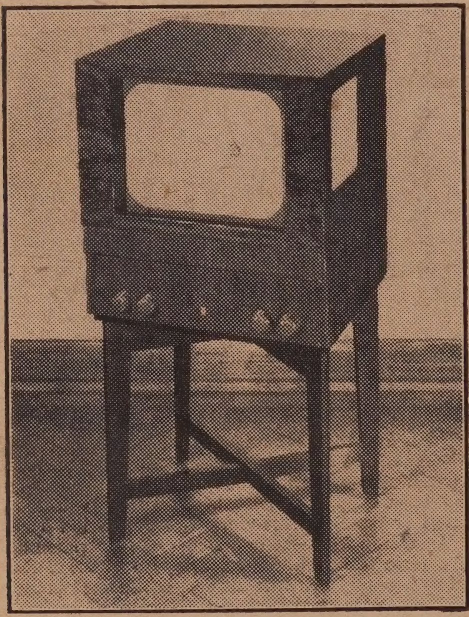
Pin No. and Connection: 1–h; 2–g; 3–NP; 4–NP; 5–NP; 6–IC; 7–IC; 8–NP; 9–NP; 10–al; 11–k; 12–h. Side contact—a2.

Dimensions.—As for MW31-17 (blown bulb).

Mullard Electronic Products, Ltd.,
Century House,
Shaftesbury Avenue, W.C.2.

Projection Table Set

PHILIPS announce a projection television table model 600A, priced at £88 14s. 6d., including tax, and with a flat screen measuring 13¾in. by 10¼in. Where



The new Philips Projection table model receiver and the special stand which can be supplied.

the owner has no suitable table, a framework stand can be supplied.

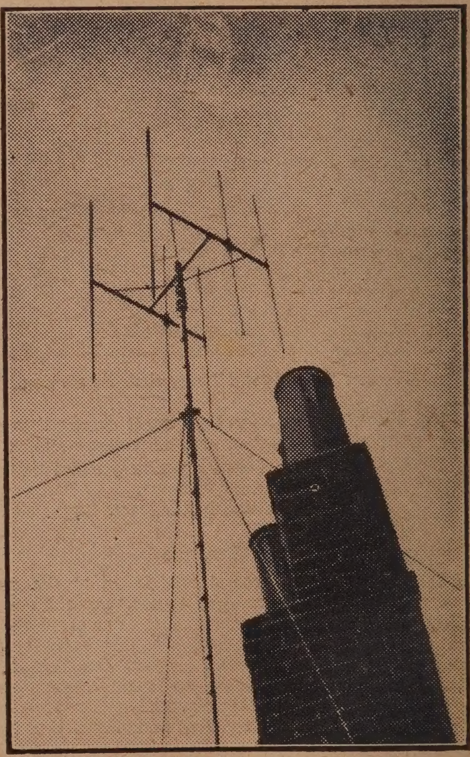
It consists of a table superhet receiver for 200-250 V, 50 c/s A.C. with walnut cabinet 13¾in. by 10¼in. flat screen; a separate oscillator and a voltage tripler circuit are employed for providing the 25,000 V required to operate the projection tube. Pre-set interference limiter is fitted to the sound channel. Consumption approximately 175 W Controls; brightness; focus; sound volume—on/off; contrast. Pre-set controls at the rear. Dimensions: 21½in. by 21in. by 18¾in. Stand £2 15s. 2d. extra.

Philips Electrical, Ltd.,
Century House,
Shaftesbury Avenue, London, W.C.2.

Fringevision Aerials

VARIOUS suggestions have been made from time to time to improve the strength of signals received in fringe areas, and an article was recently published in these pages dealing with the question. As a result we have received from Fringevision Aerial Service, details of a twin aerial system which they have developed. It consists of a twin "H" aerial and retails at £6 15s. As a further step they experimented and produced a twin six-element aerial (illustrated below), primarily for dealer demonstration purposes.

Fringevision Aerial Service,
Angel Yard,
Marlborough.



A double six-element aerial for dealer demonstrations.

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